

EVOLUTION OF WORKPLACE ARCHITECTURE AS A CONSEQUENCE OF TECHNOLOGY DEVELOPMENT

A thesis submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

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DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and, any editorial work, paid or unpaid, carried out by a third party is acknowledged.

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ABSTRACT

Workplace architecture evolves through, and is informed by, the interactions between people, space and technology. It is important, therefore to consider how future changes in these three elements might affect workplace design.

This research investigates to *what* extent and *how* information technology (IT) is changing workplace architecture.

Using a mixed method approach (survey and case studies) this research focuses upon design organisations and accountancy firms as being representative of the wide range of work activities undertaken in offices. The survey collected data from 105 organisations in Melbourne, Australia and provides a cross-section of the current workplace environment and working habits. Three case studies provide insight into current and emerging office environments including private sector and government facilities as well as emerging organisations hosted in virtual worlds.

The results suggest that, whilst IT has changed the workplace, people's natural rate of absorption of change is slowing the adoption process of IT available today. Therefore, the possible magnitude of change in workplace architecture due to technology development is restrained. Despite the high reliance on IT, office environments are shaped by human traits such as face-to-face interaction, emotions and physical space dependency. As a consequence, the role of technology as a driver of change is questioned and the role of an enabler of change favoured.

The recommendation for architects, facility managers and business managers is that the workplace should be designed, maintained and managerial styles developed for people to benefit from technology. Inverting the priority by procuring spaces and management styles based on what technology can do whilst overlooking people's needs is likely to produce unsuccessful work environments.

Keywords: Alternative Ways of Working, Architecture, Business Management, Diffusion of Innovation, Facilities Management, Information Technology, Teleworking, Virtual Worlds, Work, Workplace.

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To Mariana

ABBREVIATIONS AND ACRONYMS

| | |
|-----------------|---|
| ABS | Australian Bureau of Statistics |
| ABW | Activity Based Working |
| AEC | Architecture Engineering and Construction |
| AWW | Alternative Ways of Working |
| BBP | Better Business Performance |
| CBD | Central Business District |
| CE | Concurrent Engineering |
| CPS | Calculations Per Second |
| CPU | Central Processing Unit |
| CRT | Cathode Ray Tube |
| CS-A/B/C | Case Study A/B/C |
| FM | Facilities Management |
| HBW | Home Based Work |
| HR | Human Resources |
| ICT | Information and Communication Technology |
| IT | Information Technology |
| JTB | Justified True Belief |
| MIPS | Million Instructions Per Second |
| MMORPGs | Massively Multiplayer Online Role Playing Games |
| MUD | Multi-User Dungeons |
| MUDDLE | Multi-User Dungeon Definition Language |
| OHS | Occupational Health and Safety |
| PDA | Performance and Development Assessment |
| VDC | Virtual Design and Construction |
| TB | True Belief |
| VWH | Variable Working Hours |
| WSD | Work Sampling Diary |

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INTRODUCTION

CHAPTER

1

1.1 INTRODUCTION







This chapter provides the background of the research and introduces the research problem and its objective. The research questions are presented and the scope of the research defined. An overview of the methodology is provided. Publications derived from this research are listed and a research timeline included. Finally, the overall thesis outline is presented.

1.2 BACKGROUND

We are immersed in the Information Technology (IT) Revolution which is dramatically transforming the way most, if not all, sectors of society work, play, socialise together and undergo healing and recovery from illness. Almost every aspect of human endeavour is affected by technology change and with it the space requirements of those endeavours (Becker and Steele 1994; Castells 1996; Linturi 2000; Marmot and Eley 2000).

Advances in technology are having a major impact on shaping the office environment (Stallworth and Kleiner 1996). Universities are promoting online teaching (Oblender and Glass 2004) and hospitals are adopting state-of-the-art technology to improve health procurement (Wright 2001) in a way that not only people are changing the way they do their daily activities, but the spaces to perform such activities are also changing. Table 1.1 shows three strategic sectors of society: health, education and workplace in the early XX Century and in early XXI Century.

Table 1.1. Changes in health, education and workplace architecture.

| | Health | Education | Workplace |
|-------------|---|--|---|
| XX Century |  <p>Operating room Luft <i>et al.</i> (2004)</p> |  <p>Traditional classroom Clayton (2005)</p> |  <p>Typists at a post office Officemuseum.com (2005)</p> |
| XXI Century |  <p>Surgical Robot Butner and Ghodoussi (2003)</p> |  <p>Classroom Foote (2004)</p> |  <p>Workstations Knoll (2008)</p> |

Vitruvius, in his treatise *De architectura* (Circa 27 BC), stated that buildings are to be designed to serve three major purposes: *firmitas*, *utilitas* and *venustas* (Brill *et al.* 1984). That is, buildings should be strong (*firmitas*), useful (*utilitas*) and beautiful (*venustas*). Whilst the way architects, engineers and builders provide strength to buildings (structures) and their aesthetics have changed considerably through time, the interest of this research focuses on the way people use buildings (*utilitas*), rather than how they look or how they are supported or built. As noted by Mawson (1994) designers tend to understand form, structures and systems rather than the pressures, behaviour and needs of the modern business.

For a building to be useful it needs to support people's behaviour to perform the required activity (Brill *et al.* 1984). That is, hospitals to heal, schools to teach and offices to work. If technology is changing how we heal, teach and work, architecture needs to adapt and evolve. Bechtel (1977) argues that "*behaviour, not space, is enclosed by architecture. No dwelling, building or city is planned to be empty.*"

It is thus the evolution of the space required to support the changing way in which people behave due to technology development that is of interest to this research.

As previously discussed technology affects various (if not all) sectors of society, however this research focuses on workplace architecture (offices). This and other research constraints are further explained in section 1.5 *Research scope*.

The word '*evolution*' in the research title was chosen to allude to the Darwinian natural selection process to which the different variants of workplace architecture (mutations) are submitted. The variants which perform better will prevail over the others and redefine workplace architecture.

1.3 RESEARCH PROBLEM

Robertson (2000) sustains that all organisations have three key components: people, space and technology. Usually these components are managed by the Human Resources (HR), Facilities Management (FM) and Information Technology (IT) departments, respectively (excluding any specialised divisions required for managing activities such as manufacturing and processing). However, these groups rarely interact with each other and are mainly concerned about their own area of responsibility. Therefore, the HR group is seen as the group that focuses on initiatives that are good for the employees, but without clearly adding real business value. The FM group is regarded as mainly interested in cutting real estate costs by relying on old paradigms (e.g. reduce the size of workstations) and rarely do they offer leading-edge solutions to space challenges. Finally, the IT group seems to deliver technology for the sake of technology, without fully taking into consideration people or space management issues.

Robertson identified that for organisations to achieve their desired business objectives they must acknowledge the critical link between people, space and technology. Figure 1.1, shows the interaction between each area and recognises the inter-dependency amongst them.

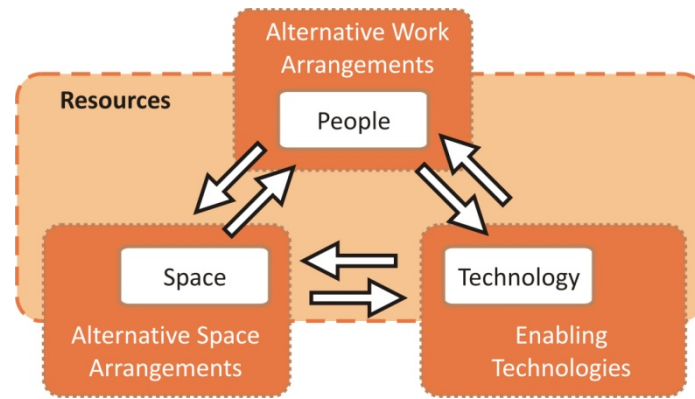


Figure 1.1. People, space and technology (Robertson 2000).

A number of similar models, discussed in the first section of Chapter 2, tend towards the same common conclusion that people, space and technology (different models use different terms) are key elements in every organisation and a key to achieving a good design and meeting corporate objectives. Most importantly, all models stress that as noted by Becker and Steele (1994) *“changes in any of these factors are likely to change the organisational ecology”*. Since a change in technology will impact both people and space, new technology will not only require an adequate space, but a compatible managerial style.

What is more, a functional architectural space needs to take into consideration the behaviour and activities that take place in such space as much as the characteristics of the people doing them. As an example, Generation Y in Australia has been labelled the most educated generation in history due to 77%, record-high, Year 12 retention rates (McCrindle 2008). Also referred to as the Internet generation, 97% of Generation Y owns a computer, 44% reads blogs and 97% have a mobile phone (Junco and Mastrodicasa 2007). Thus, the Generation Y expectations of the workplace environment are likely to be different from those of previous generations.

Authors such as Becker and Steele (1994), Stocks (1998), Linturi (2000), Marmot and Eley (2000), Martino (2001), and Robertson (2000) amongst others discussed in Chapter 2, agree that IT has changed the way we work. Moreover, they recognise that office work is no longer confined to an office environment because mobile technology allows people to work as effectively from home, airports or cafes.

Information technology is challenging architects designing adequate environments, facility managers managing their current facilities whilst planning for the future and clients understanding how to exploit the benefits offered by IT. This thesis aims to be a step forward in helping architects, facility managers and clients to better understand the new *utilitas* of office buildings.

1.4 RESEARCH OBJECTIVE

The objective of this research is to study *how* and to *what extent* changes in technology are changing workplace architecture.

By satisfying its objective, this research will help:

- **Architects** to better design office environments based on emerging work paradigms fostered by new technologies;
- **Facility Managers** to better handle strategic planning by taking into consideration changes in space requirements due to alternative ways of working; and
- **Business Managers** to better develop and implement managerial methods and styles required by flexible workplaces and alternative ways of working.

1.4.1 Research questions

The two main research questions are:

- a) **To what extent is information technology changing workplace architecture?**
- b) **How is information technology changing workplace architecture?**

The above '*Grand-tour*' questions (the broadest questions of the study) are broken down into sub-questions in Chapter 3.

1.5 RESEARCH SCOPE

The scope of the research is discussed below:

- **Offices:** The complexities of studying changes in architecture (space requirements) caused by technology development across all sectors of society (hospitals, education, industry, etc.) exceed the capacity of a single researcher. Thus, this research focuses on office-like environments. It is considered, however, that other types of buildings have an office component in them and can also benefit from this research. For example, whilst the characteristic space of universities is the classroom, they also have an important office component to accommodate academic and administration staff.
- **Aesthetics:** It is beyond the scope of this study to comment whether there is a gain or loss in the aesthetics (*venustas*) of workplace architecture due technology development.
- **Work technologies:** Only IT technology used for work related activities is taken into consideration (e.g. computers, Internet, webcams, e-paper, etc). Other technologies also affecting workplace architecture, but not directly the collaboration process are excluded (e.g. HACV, illumination systems, elevators, etc.). Furthermore, the focus of the research is the impact of technology in workplace architecture, not technology itself. This is further discussed in Chapter 2.
- **Research design:** The research epistemological position, theoretical perspective, methodology and method(s) impact and constrain the meaning of the research questions, the purposiveness of research methodologies, and the interpretability of research findings as well as the extent to which such findings can be generalised. This is further explained in Chapter 3, Chapter 11 and Chapter 12.

1.6 METHODOLOGY

To address its research questions, this study relies on five research efforts: a literature review, a survey and three case studies.

- **Literature review** (Chapter 2): The literature review was an ongoing process from the start of the research (to set its context) to the write-up of the conclusions (to help interpret the results). It covers a variety of social, technological and design topics.
- **Survey** (Chapter 7): In September 2007, 105 (out of 284 sampled) companies in Melbourne (CBD and its suburbs) participated in a survey designed to provide a cross section of the current workplace environment and working habits. The questionnaire measured 67 variables including office environment satisfaction, level of technology adoption, working habits and alternative ways of working. The collected information allowed the researcher to identify (amongst other things):
 - Differences between working environments in the city and the suburbs;
 - Differences between professions (accountants and designers);
 - Differences between adapted spaces and purpose designed offices;
 - Level of technology adoption;
 - Hours worked per week; and
 - Level of adoption of Alternative Ways of Working
- **Case Study A (CS-A)** (Chapter 8): Following the survey, an in-depth case study was undertaken in October 2007 to analyse a contemporary working environment. For one week, five participants of an architectural design firm used a Work Sampling Diary (WSD) to register their working habits. The study was complemented by an analysis of the floor plan and individual working stations. Participants also completed the above-mentioned survey.
- **Case Study B (CS-B)** (Chapter 9): CS-B provides a glimpse into the possible future (available today) of workplace architecture. This case study is about virtual worlds hosting office-like working environments. CS-B took place in September 2008 and is based on two companies: the company developing the technology and a user of such technology. This case study took place in London (developer company) and Manchester (technology user). A variety of methods were used to collect data for this study including the survey, WSD and face-to-face interviews.
- **Case Study C (CS-C)** (Chapter 10): CS-C was done in December 2008 focusing on teleworking and hot-desking. This case study provides an insight into the motivations of a manager of a government organisation who considered working from home. The study included the administration of the survey, the WSD and a face-to-face interview.

1.7 CONFERENCES AND PUBLICATIONS

1.7.1 Conferences as delegate

The PhD candidate attended as delegate to the following international conferences:

- **Worktech'07**, Cordless Group, London, UK, 2007
- **8th Annual Occupiers Conference**, Cushman & Wakefield, London, UK, 2007
- **Worktech'08**, Cordless Group, Shanghai, China, 2008

Both Worktech conferences were outstanding forums for establishing access to case studies as to discussing the research with international workplace consultants as well as peer researchers. Worktech '07 inspired CS-B.

1.7.2 Conferences as presenter

The following papers were presented at peer-reviewed international conferences. All publications are from the researcher with the support of the supervisors, other researchers and industry advisor as indicated.

- a) Chevez, A., Aranda-Mena, G. and Edwards, P. "**Facilities Management as the Catalyst to Accelerate Evolutionary Changes in Workplace Architecture**", Second International Conference of the Cooperative Research Centre for Construction Innovation, Gold Coast, Queensland, Au. 12-14 March 2006.

This conceptual paper calls for a well planned adoption process whilst implementing Alternative Ways of Working (AWW) in order to ensure implementation success. Based on strategic asset management together with Rogers' diffusion of innovation theory, a method is proposed to accelerate the adoption process of AWWs whilst keeping the balance between people, space and technology. This paper is based on *Chapter 2: Literature Review*.

- b) Chevez, A., Aranda-Mena, G., Edwards, P. and Calder, J. "**Research model for evaluating the impact of technology in workplace design in Australia**", Third Conference for Postgraduate Researchers of the Built & Natural Environment (PRoBE), Glasgow, UK. 20-22 November 2007.

Based on *Chapter 3: Research Design* and *Chapter 5: Test of the research design and instrument*, this paper discusses the importance of the epistemological and ontological position, theoretical perspective, methodology and methods adopted by the study. The results of the reliability test are discussed under the provocative research paradigm adopted by the research. The paper was awarded best runner-up conference paper.

- c) Chevez, A., Aranda-Mena, G., Edwards, P., Calder, J. "**Reaching singularity point in workplace architecture**", Third International Conference of the Cooperative Research Centre for Construction Innovation, Gold Coast, Queensland, Au. 12-14 March 2008.

Based on *Chapter 2: Literature Review*, this paper examines the close relationship between technology and society. The paper focuses on the concept of singularity point in which the technological change will be so rapid, its impact so deep, that when reached, human life will be irreversibly transformed. These changes will transform the concepts that we rely on to give meaning to our lives; including our business models. Reaching singularity would result in an unprecedented change in workplace architecture.

- d) Chevez, A., Lopez, R., Aranda-Mena, G. and Edwards, P. "**Human reliability as a Source of Error in Research**", Annual Conference of Association of Researchers in Construction Management (ARCOM), Glamorgan, UK, 2008.

This paper is based on *Chapter 7: Survey* and reports the results of a quality checking process developed to monitor the transcription of data from paper-based questionnaires into the computer.

1.7.3 Other presentations

- *'El futuro de los espacios de trabajo'* (The future of workplace architecture), Colegio de Arquitectos (Mexican Institute of Architects), Mexico City, 2008.

The researcher was invited to present a conference on workplace architecture at the Mexican Institute of Architects.

1.8 RESEARCH TIMELINE

Figure 1.2 shows the overall research timeline indicating the inputs to the research (data collection, conferences as delegate and ongoing literature review) and the outputs of the research (conference papers). The research was done part-time from early 2005 to the end of 2006. From 2007 onwards the research was undertaken in a full-time enrolment.

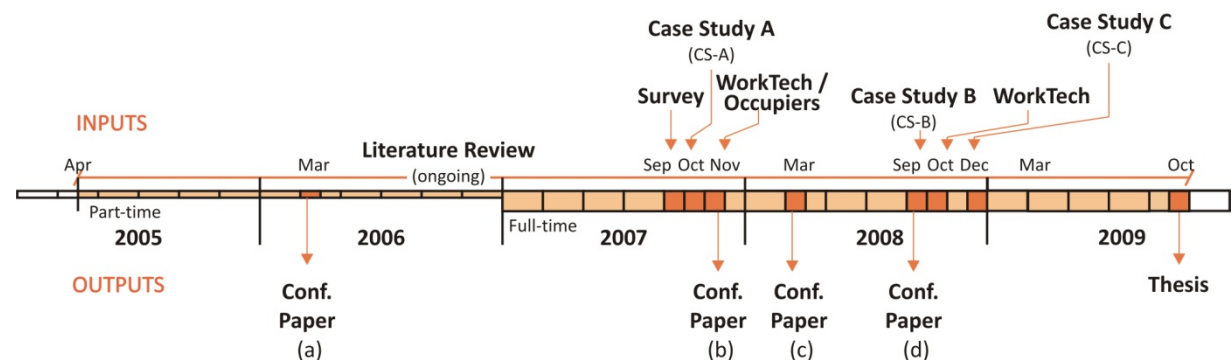


Figure 1.2. Research timeline

1.9 THESIS OUTLINE

Chapter 1 Introduction

This chapter provides the background of the research and introduces the research problem and its objective. The research questions are presented and the scope of the research defined. An overview of the methodology is provided. Publications derived from this research are listed.

Chapter 2 Literature review

This chapter reviews the literature to provide the knowledge context of the research and the background required for the discussion of the survey and case studies. It discusses a variety of topics including a review on the relationship of the people-space-technology trilogy as well as each individual component. This chapter also reviews the history and the future of the office, alternative ways of working and technologies that can affect workplace architecture. Diffusion of innovation theory is also discussed in the realm of the evolution of the office.

Chapter 3 Research design

This chapter defines the research questions as well as develops and justifies the proposed research design and methodology to address them. The adopted research approach and epistemological context discussed in this chapter determine the significance and interpretability of the research findings.

- Chapter 4 Development of the research instrument**
This chapter details the process of developing the research instrument (survey) and administration process to collect the data required to address the research questions. It reviews reliability and validity principles as well as questionnaire format and administration techniques. Reporting and analysis methods are also discussed.
- Chapter 5 Test of the research instrument**
This chapter describes the testing of the proposed research instrument together with the administration and analysis techniques developed in the previous chapter. Identified gaps and shortcomings of the proposed method are discussed.
- Chapter 6 Refinement of the research instrument**
Based on the identified gaps and shortcoming documented in the previous chapter, a revised approach is discussed. The original survey is modified and case studies are proposed to complement the limitations of the survey. A mixed method paradigm is developed and analysis techniques developed.
- Chapter 7 Survey**
Documents the administration of the survey as well as the methods developed to ensure the quality of data used for analysis. Collected data is analysed and the results coded for discussion in Chapter 11.
- Chapter 8 Case study A (CS-A)**
Documents a contemporary working environment. Collected data is analysed and the results coded for discussion in Chapter 11.
- Chapter 9 Case study B (CS-B)**
Documents a case study based on virtual worlds as possible environments hosting the office of the future. Collected data is analysed and the results coded for discussion in Chapter 11.
- Chapter 10 Case study C (CS-C)**
Documents a case study focusing on teleworking and hot-desking. Collected data is analysed and the results coded for discussion in Chapter 11.
- Chapter 11 Discussion of results**
This chapter discusses the results obtained in Chapters 7, 8, 9 and 10 and relate them to the literature review.
- Chapter 12 Conclusions and recommendations**
Provides the conclusions and recommendations of the research. The contributions of the research are outlined and topics for further research proposed.

This thesis includes 15 appendices as listed below. To facilitate cross-referencing, the appendix number refers to the chapter it belongs to. Chapters 1 to 3 and 12 do not have appendices.

- Appendix 4a:** Test-survey kit
Appendix 5a: Reliability analysis tables
Appendix 6a: Survey kit
Appendix 6b: Case Study A kit
Appendix 6c: Case Study B protocol
Appendix 6d: Case Study C protocol
Appendix 6e: Questionnaire / report key
Appendix 7a: Error monitoring

- Appendix 7b:** Quality of data provided by respondents
- Appendix 7c:** Analysis supporting tables
- Appendix 8a:** Survey and WSD reports
- Appendix 9a:** CS-B data quality
- Appendix 9b:** Survey and WSD reports
- Appendix 10a:** Survey and WSD reports
- Appendix 11a:** Compilation of results
- Appendix 11b:** χ^2 Test reports

LITERATURE REVIEW

CHAPTER

2

2.1 INTRODUCTION

A literature review is an account of what has been published on a topic by accredited scholars and researchers (Taylor and Procter 2002). Therefore, this chapter provides the knowledge context of the research by integrating and summarising what it is known in the field (Wisker 2001) in order to help define the scope of the research (Newman 2000).

This literature review uses a thematic structure, as opposed to a progression of time, and as such is organised around various topics considered key to the study. Nevertheless, progression of time is an important factor within each topic (UNC 2005).

Below is a review of the literature on the roles and effects of people, space and technology in workplace architecture.

2.2 PEOPLE, SPACE AND TECHNOLOGY

The relationship between people, space and technology was introduced on Chapter 1 through Robertson's model. Following is a review of similar models by other authors. It is paramount for the research to substantiate this relationship as it is at the core of the study.

Using the concept of '*organisational ecology*' Becker and Steele (1994) describe the relationship between people, space and technology, refer to Figure 2.1. They define organisational ecology as the way "*organisation's leaders choose to arrange their employees in space and time in pursuit of a long-term competitive edge.*" The three key elements of organisational ecology are: 1) the physical settings in which work is carried out, 2) the processes used for planning and designing the workplace system, and 3) the way space, equipment, and furnishings are allocated and used over time. Amongst the factors defining the organisational ecology are the nature of the work and business processes themselves, the organisational culture and corporate values and real estate cost, usage and location. "*Changes in any of these factors are likely to change the organisational ecology.*" (Becker and Steele 1994).

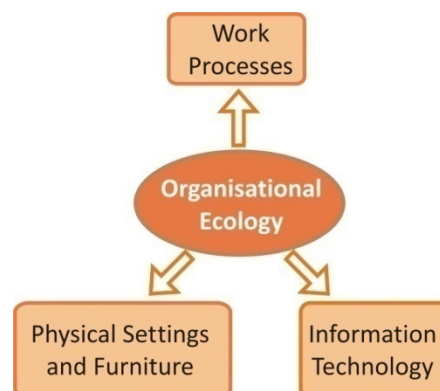


Figure 2.1. The Organisational Ecology (Becker and Steele 1994).

The Learning Building Group (LBG), which involves nine Anglo-Scandinavian companies, got together in 1991 to develop workplace solutions based on the future needs of organisations (Mawson 1994). As a result they developed The LBG Pyramid as shown on Figure 2.2.

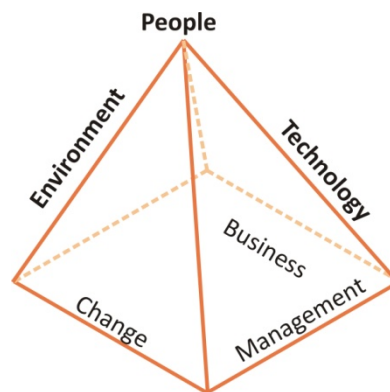


Figure 2.2. The LBG pyramid (Mawson 1994).

At the apex of the LBG pyramid are the people as it is considered that the sole purpose of systems, structures and scenery is to allow people to work to their full capacity during the period of building occupancy. The LBG Pyramid reflects the need to understand an office building as a whole, holistically, without the luxury of designing a building in '*splendid isolation*'. In this regard, Mawson (1994) defines the building as a business tool that must sustain the business and technological challenges of an uncertain future.

Sayers (2006) based on Johnson and Scholes (1989), created the S.E.T. (Social, Environmental and Technological) model, refer to Figure 2.3. The novelty of this model is the inclusion of a generational filter. Sayers argues that in order to understand workplace change it is important to identify the changing aspects of the world around us. Her S.E.T. model considers the shifts in attitudes and preferred working style and values defined by generations (see section 2.3 *People*).

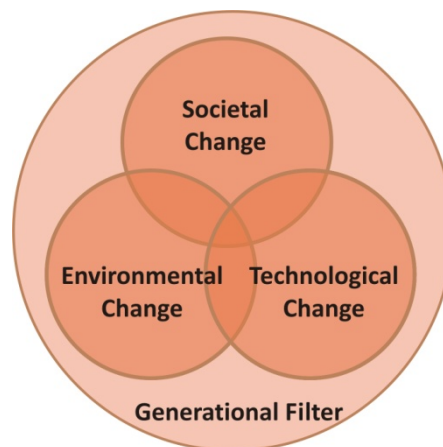


Figure 2.3. S.E.T. model (Sayers 2006).

Finally, based on the need to adopt new perspectives for workplace design as a consequence of the rapid growth of the information society, The Sustainable Accommodation in the New Economy (SANE), a €6 million and two year project of seven organisation from four

European countries identified three key ‘environments’ that must be considered for the workplace design: people, space and technology (Fernando 2003).

Besides tending towards the same common conclusion that people, space and technology are key elements in every organisation and a key to achieving a good design as well as meeting corporate objectives, all models denote that a change in one element will impact the remaining. In the context of this study it means that a change in technology will impact both, people and space. Therefore, new technology will require not only different, or even new spaces, but compatible managerial styles and even shift in attitude. A review of developing technologies that are more likely to create an imbalance between people and space is offered in section 2.11 *Developing technologies*.

A review done by Steiner (2005) on a 2004 study undertaken by the British Council for Office, concludes that workplaces and the way office space is used is shaped by four key factors as described below:

- 1) **People:** The human factor is an increasingly fundamental issue. The future workforce and resulting economic success will be a key driving force for all aspects of office design in the future.
- 2) **Location:** Office location will remain important in the future, but specification and design will become a lot more important.
- 3) **Management and work-styles:** Management styles must adapt to fit a faster-moving, ideas-based environment and cope with a more mobile workforce, as there will be an increase in the freelance ‘knowledge worker’ (see section 2.3.1 *Knowledge workers*) who will, migrate from project to project. Traditional benchmarks such as organisation charts, job titles, seniority and cost per employee will no longer dictate workplace design.
- 4) **Technology:** Technology will be seen as an enabler not a driver of change. Whilst technology has enabled greater worker flexibility for over 20 years, this flexibility and its options have not been as fully implemented as many would have expected.

Interestingly, the above four points could also be grouped into people, space (location) and technology; management and work-styles (point 3) could be considered as the link between people and technology.

2.3 PEOPLE

“The most critical resource wears shoes and walks out the door around five o’clock everyday.”

Ridderstrale and Nordstrom (2000)

According to Sayers (2006) in Australia there are currently four generations coexisting, and competing against themselves and each other in the workplace. Each has different values and attitudes towards work. However, from these four, the Mature generation (the oldest one in the workforce) is either retired or set to retire in the next three to five years (from 2006). The generations that will dominate the workplace in the future (10-15 years) are: the Baby Boomers, born between 1945-1963, Generation X, born between 1964-1977 and Generation Y, born between 1978-1994.

Smith and Clurman (1997) refer to members of a generation as being linked through their shared experiences, sensory perceptions, visual memories and technology. Thus, cohorts develop and retain similar values and life skills. Ryder (1965) defines a cohort as: *“the aggregate of individuals (within some populations’ definition) who experience the same event within the same time interval... suggesting that... each cohort has a distinctive composition and character, reflecting the circumstances of the unique origination and history”*.

On the other hand, as noted by Sayers (2006) using a generational lens only does not take into account psychological and many other cultural factors that also are important to understand individuals. Meredith *et al.* (2002) argue that *“generalisations about cohorts never hold for all members of a cohort. Inherent aspects of personality and formative experiences that shape personality also drive a person’s character...within any group of people of the same age, you will find some people who are not typical of their cohort”*. Cole *et al.* (2002) also warn against generalising about generations, as if gender, culture and personal preference do not exist.

Nevertheless, generational cohorts can help to group people by defining moments and common characteristics that could prove useful for workplace analysis. Table 2.1 summarises the work values and work definition by each generation as adapted by Sayers (2006) from Meredith *et al.* (2002); Smith and Clurman (1997) and Zemke *et al.* (2000).

Table 2.1. Working styles of different generations (Sayers 2006).

| Generation | Year of birth | Work values | Work is: |
|---------------------|---------------|--|-----------------------------------|
| Mature | 1920-1944 | Hard working, Conservative, Organisational loyalty | An inevitable obligation |
| Baby Boomer | 1945-1963 | Quality of life, Ambitious, conforming Organisational loyalty | An exciting adventure |
| Generation X | 1964-1977 | Flexibility, job satisfaction, loyal to self, balance work/life | A difficult challenge |
| Generation Y | 1978-1994 | Value diversity, Sociability, global mindset, technology savvy. | A means to an end – work to live! |

Centron and Davies (2005) suggest that employers will need to adjust virtually all policies and practices to fit the values of Generation X and Generation Y, including providing innovative ways and ideas on how best to motivate them and reward them (Sayers 2006).

A poll of 315 small and medium-sized businesses across Australia conducted by Smart Company and Roy Morgan in 2007 concludes that Generation Y is *‘impatient’* and *‘bad at communicating’*. The survey also found that almost 70% of those surveyed found Generation Y to be dissatisfying, with poor spelling and grammar and no understanding of appropriate corporate behaviours (Casben 2007). However, these might be biased perceptions based on a common and still current belief that younger generations do not reach the standard of older generations. As said by the Greek poet Hesiod in the VIII Century BC: *“I see no hope for*

the future of our people if they are dependent on frivolous youth of today, for certainly all youth are reckless beyond words. When I was young, we were taught to be discreet and respectful of elders, but the present youth are exceedingly wise [disrespectful] and impatient of restraint” (Sayers 2006).

As shown on Table 2.2 a major factor influencing the generation is the changes in technology in each generational era.

Table 2.2. Representative technologies by generation (Sayers 2006).

| Mature | Baby Boomer | Generation X | Generation Y |
|-------------------|-------------------|--------------------|-------------------------|
| Slide-rule | Calculator | Desktop computer | Graphics calculator |
| Mimeographing | Photocopying | Scanning | Bluetooth |
| IBM | Apple | DOS & Windows | Linux / DVD / USB |
| Switchboard | Touch-tone phones | Mobile phones | Instant Messaging / SMS |
| Party lines | Conference calls | Video conferencing | VoIP & Web Cams |
| Traditional post | Telex | Fax | Email |
| Tape reel to reel | Cassettes | CD | MP3 |

As concluded by Sayers (2006) from her research on *Australia’s Changing Workplace: A Generational Perspective*, generations have different levels of comfort and competency with technology and prefer different means of communication. Whilst Baby Boomers consider themselves as holding a good level of competency with technology used in their workplace, Generation X and Y disagree on their self-assessment and consider Baby Boomers less than competent with technology use. Face-to-face is the Baby Boomers’ preferred means of communication. On the other hand, Generation X feel that they have a good grasp of the technology used in their workplace (the other generations agree with their self-assessment) and consider the telephone to be the most effective mean of communication. Finally, Generation Y are not excited by the technology used in their workplace (they considered it out of date) and some of them mentioned being ‘sick’ of being seen as the IT help-desk by the Baby Boomers. Email was Generation Y’s preferred mode of communication.

Junco and Mastrodicasa (2007) found through a survey applied to 7,705 Generation Y college students in the US, that:

- 97% own a computer;
- 94% own a cell phone;
- 76% use Instant Messaging (IM);
- 15% of IM users are logged on 24 hours a day/7 days a week;
- 34% use websites as their primary source of news;
- 28% own a blog and 44% read blogs;
- 49% download music using peer-to-peer file sharing;
- 75% of college students have a Facebook (social network) account; and
- 60% own some type of portable music and/or video device such as an iPod.

The level of adoption and familiarisation with technology of Generation Y has industry observers like Hamel (2009) concerned by the disparity of values between these future employees and the current workplace environment. *“The experience of growing up online will profoundly shape the workplace expectations of ‘Generation F’ – the Facebook Generation [referred in this research as Generation Y]. At a minimum, they’ll expect the social environment of work to reflect the social context of the Web, rather than as is*

currently the case, a mid-XX-century Weberian bureaucracy.” He argues that the social DNA of Generation Y is missing from the managerial DNA of the average Fortune 500 company. Hamel warns *“In the future any company that lacks a vital core of Gen F employees will soon find itself stuck in the mud.”*

2.3.1 Knowledge workers

As per Elliman *et al.* (2005) the term ‘*knowledge worker*’ appears to have been introduced by Peter Drucker in the late 1950s. He described the knowledge worker as somebody *“who puts to work what he has learned in systematic education, that is, concepts, ideas and theories, rather than the man who puts to work manual skill or muscle”* (Drucker, 1959).

The term knowledge worker has since been defined in a number of different ways, suggesting that there is no set definition for the term. However, Elliman *et al.* (2005) believe that Kidd (1994) provides one of the clearest and more useful definitions, because it narrows down the number of workers that can be defined as knowledge workers: *“the defining characteristic of knowledge workers is that they are themselves changed by the information they process.”*

Although it can be argued that the above is true for all human beings, Kidd says that information is the primary motivation of knowledge workers and the job that they are paid to do. Thus, under Kidd’s definition clerical and communication workers are not knowledge workers, because the information is external to the person and does not change/inform them. Elliman *et al.* (2005) clarify this by explaining that communication workers arrange information from other sources in order to change other people’s understandings and beliefs, rather than their own. The job of the clerical worker is to know what information to use in different situations and apply it in a way that will produce consistent outcomes.

2.4 SPACE (AND CYBERSPACE)

“We could think of a building in terms of the interface between the content and the space: as software interfaces organise the electronic space to host content (e.g. tools for word processing) , so buildings contain and organise space, and make their content accessible and useable.”

Cicognani (2003)

Space as defined by the Encyclopaedia Britannica (2009) is a boundless, three-dimensional extent in which objects and events occur and have relative position and direction. By applying order and hierarchy to space, architects are able to provide comfortable and consistent environments to be used as workplaces and other environments (Cicognani 2003).

Lefebvre (1991) in Cicognani (1998) argues that until recently, the word ‘*space*’ had a strictly geometrical meaning and the idea it generated was simply that of an empty area. Further, when used in a scholarly context it is usually accompanied by epithets such as ‘*Euclidean*’, ‘*isotropic*’, or ‘*infinite*’, which gives the general feeling that space is ultimately a mathematical concept. However, Lefebvre, opens the term to social sciences and describes three types of space: *physical space*, which refers to nature (e.g. the Cosmos); *mental space*, that of logical and formal abstractions; and *social space* referring to social interactions. Far

from being separated from each other, together they shape the complexity of the nature of space and its variables (Cicognani 1998).

Cicognani (1998) sees an interesting parallel between Lefebvre's spaces and Popper (1972) definitions of the 'three worlds'. Popper's *world 1*, equivalent to Lefebvre's physical space, is the world of material, of physics and natural things. Energy, motion and state change are part of this world. *World 2*, equivalent to Lefebvre's mental space, includes consciousness, thoughts, intentions, memory and dreams. Finally, *world 3*, equivalent to Lefebvre's social space, is the result of interactions of humankind and public structures.

Bartle (2004) makes the distinction between space and place. He refers to a space as an abstraction that groups objects of a particular type under a set of fixed rules; a place is a region (under adjacency rules) of some space. For example, matter operating under the laws of physics results in a 3D space we call reality. A place is a subset of its space.

Technology has created a new type of space, an electronic space known as cyberspace. The term cyberspace was coined by William Gibson in 1982 in a science fiction novel. He later confessed that the term "*seemed evocative and essentially meaningless. It was suggestive of something, but had no real semantic meaning, even for me, as I saw it emerge on the page*" (Cicognani 1998, Wikipedia 2009a). Despite its uncertain meaning whilst created, the word 'cyberspace' is now included in dictionaries and refer to "*the online world of computer networks and especially the Internet*" (Merriam-Webster's Collegiate 2009) or "*all of the data stored in a large computer or network represented as a three-dimensional model through which a virtual-reality user can move*" (Collins English Dictionary 2004). Cyberspace is commonly used as a synonym of virtual worlds.

Cyberspace is not a place for molecular manifestation, but results of electronic transformation of linguistic events. A characteristic of space is its livability, or the possibility of dwelling. If livability is defined by 'molecular presence', then cyberspace is not livable (Cicognani 1998).

Cicognani (1998) makes the following insightful observations on the various types of spaces:

- physical space has possibility of action, livability, can host communities and can be organised in spatial sub structures. Its time is irreversible: we do not have control over it;
- mental space does not have any livability characteristic, neither possibility of action or spatial organisation. Mental space is where intentions are formulated and organised;
- cyberspace has control over its time, whereas physical space is affected by its irreversibility;
- cyberspace is an 'actual' zone, activities can take place there, such as exchange of information, modifications of computer generated environments, communities can find ways of aggregation (e.g. newsgroups, mailing lists, all language-based environments);
- communities, intended as groups of people sharing the same interests, as well as actions, are also possible in cyber-, physical and social space;
- mental space is, above all, the space in which the organisation of communities and actions, and therefore their time are shaped; and
- the matter of cyberspace is language: it is written by it, and it is navigable by it, the navigation tools are nothing else but pieces of software (e.g. language).

The topic of cyberspace/virtual worlds is paramount to this research because they can ease and decongest physical world situations, or create new solutions to common architectural problems (Cicognani 2003), including office environments. Further discussion on virtual worlds is done in section 2.11.4 *Virtual worlds*. Chapter 9 documents the case study on a company that developed a (virtual) office in Second Life (a virtual world).

In the context of this research space (virtual or real) is where people interact and collaborate for work related purposes.

2.5 TECHNOLOGY

The conventional dictionary definitions of technology (Collins 2004; Merriam-Webster 2009) elude the true meaning of technology. This is because technology cannot be defined without its purpose, without it technology remains a meaningless concept (Chaharbaghi and Willis 2000). Thus, there is not a single definition of technology. Smith and Sharif (2007) argue that for a social scientist, technology could be the underlying change agent advancing society; for an economist it could be the enabling force that improves productivity on a global scale.

Drucker (1970) defines technology as *“not about things: tools, processes, and products; it is about work: the specifically human activity by means of which man pushes back the limitations of the iron biological law.”*

The term technology comes from its Greek root *‘techne’*, meaning every art, making perfect what seems imperfect in nature. As noted by Drucker (1970) we have managed to fly not by the process of biological evolution, but through technology. Drucker’s perspective challenges the technologists’ definition of technology which is about *“how things are done or made”*, and advocates the idea that technology is *“how man does or makes”*. This distinction is fundamental as it opposes the traditional concept that technology is something extrinsic to humans, and instead favours the idea that it is part of the human nature (Chaharbaghi and Willis 2000).

Chaharbaghi and Willis (2000) sustain that *“technology is generally viewed as something extrinsic, ignoring the fact that we have always been technology creatures, technology is intrinsic to us. When technology is viewed as intrinsic, humans drive technology. This is the reason why the most appropriate technologies are those which develop a natural relationship with us.”*

2.5.1 The technology of technology

Chaharbaghi and Willis (2000) argue that the greatest invention of humankind cannot be found in technologies themselves, but in the technology of technology. They define the technology of technology not as a fixed state of being (technology itself) but as a natural process of becoming. Based on that, they developed the technology of technology four phase model, refer to Figure 2.4.

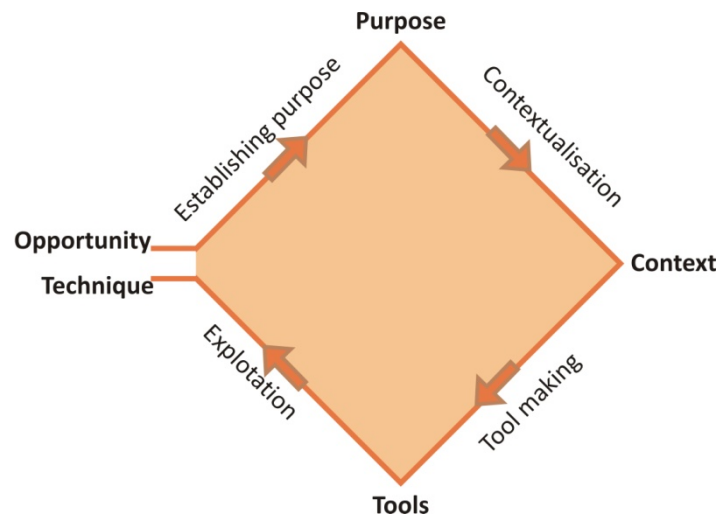


Figure 2.4. Technology of technology (Chaharbaghi and Willis 2000).

From the above figure: purpose, context, tools and techniques are the result of:

- **Establishing purpose:** Purpose is the reason for which the technology is done, created or exists. Creativity is the driving force behind technology as it is the one which identifies the opportunities.
- **Contextualisation:** For the technology to be exploited it needs a definition of the exact context within which it is to be exploited. The delivery system needs to be compatible with this context.
- **Tool making:** The implementation of the delivery system involves the manufacture of the tools necessary for consistent exploitation of the opportunity. The subsequent outcome is what toolmakers refer to as technology.
- **Exploitation:** Is when the consumer benefits from the technology. The resulting technique describes the relationship the consumer establishes with the technology. This relationship varies from individual to individual depending on the context in which they find themselves and the way in which technology impacts on them. The individualistic nature of this relationship implies that technology cannot be considered as a factor of production, but more a tool and what people do with the tool can help or harm their productivity.

As technology moves across the above stages, it acquires different orientations of meaning. At the contextualisation phase the meaning of technology adopts an '*original orientation*', which refers to the promise of a better future that does not yet exist. Then technology acquires a '*directional orientation*'. That is, newly conceived technology provides a new context, enabling things to be done that could not be done before, or existing things to be done differently. The emphasis of the operational orientation is on how a result is brought about through tool making. Finally, the '*relational orientation*' refers to how consumers organise themselves with technology in order to fulfil the purpose it was created for. It also concerns how technology affects consumers in terms of both negative and positive qualities (Chaharbaghi and Willis 2000).

2.5.2 Singularity point

Singularity as defined by Kurzweil (2005) is a point in time in which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed. The concepts that we rely on to give meaning to our lives will change. The concept of

singularity, based on the exponential growth of technology, was first exposed in the 1950's by John von Neumann, an information theorist. Von Neumann said that the ever-accelerating progress of technology gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue (Ulam 1958).

Kurzweil argues that technological change is exponential. This means that technology capability starts slowly and is virtually unnoticeable, but beyond a certain point (known as the knee point) the curve turns explosive and profoundly transformative, drastically changing the future. Figure 2.5 plots the Million Instructions Per Second (MIPS) speeds achieved by each successive computer processor chip development and relates it to time (year). It is worth noting that although the increase looks linear, the scale is logarithmic.

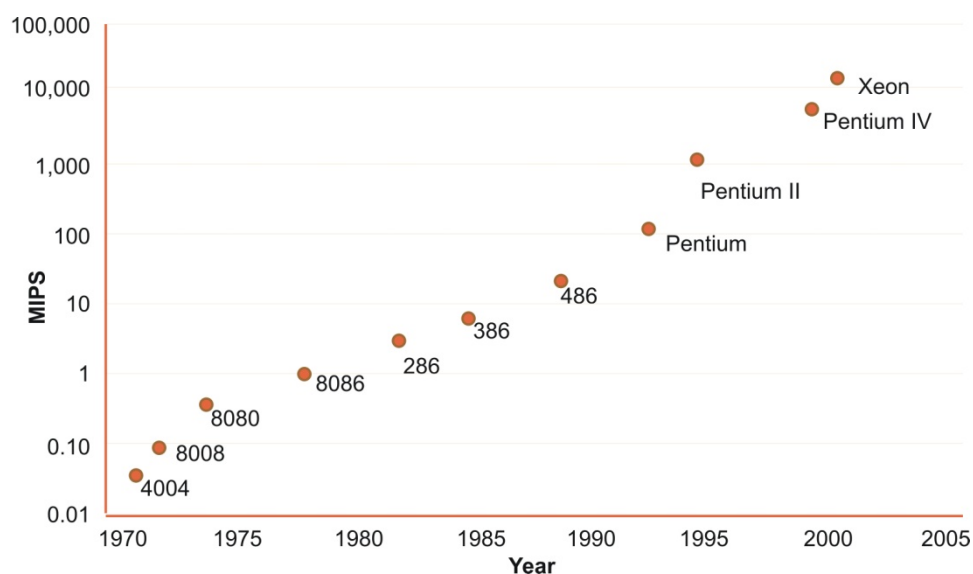


Figure 2.5. MIPS (Million Instructions Per Second) by processor (Kurzweil 2005).

In 1970 Gordon Moore (later chairman of Intel) observed that twice as many transistors can be fixed into an integrated circuit every 24 months, doubling the processor's performance. This later became known as Moore's law. Likewise, the cost of technology has dropped following a similar trend. In 1968 one transistor cost USD\$1; in 2002 that same amount of money purchased about ten million transistors. The number of transistors in Intel processors has doubled every two years and their performance, measured in MIPS has doubled every 1.8 years per processor (Kurzweil 2005).

2.5.2a 2045 The year of singularity

Kurzweil (2005) believes that by 2030 we will be producing about 10^{26} to 10^{29} CPS (Calculations Per Seconds) of nonbiological computation power. This is roughly equal to the estimated capacity of all living biological human computation, but not a profound expansion of it. Kurzweil, therefore, sets 2045 as the date for singularity, by then "*the nonbiological intelligence created will be one billion times more powerful than all human intelligence today*" (Kurzweil 2005). Linking intelligence with processing power takes a considerable amount of Kurzweil's book and opens the discussion for artificial intelligence which is beyond the scope of the research.

Kurzweil's estimations are based on Moravec (1998). The latter argues that 100 million MIPS could do the job of the human brain's 100 billion neurons. Thus, one neuron is worth 1,000 instructions per second. Finding three dimensional objects in a clutter, known as "*bin-picking*", requires 10,000 MIPS (Moravec 1998).

Moravec (1998) argues that a 100 million MIPS computer may be programmed to '*think*' like a human, but humans cannot imitate 100 million MIPS computers because our general purpose calculation ability is under a millionth of a MIPS. The considerable excess of processing power goes to simulate thinking.

Figure 2.6 plots MIPS per \$1,000 (USD) against time and compare it with the processing power of different organism.

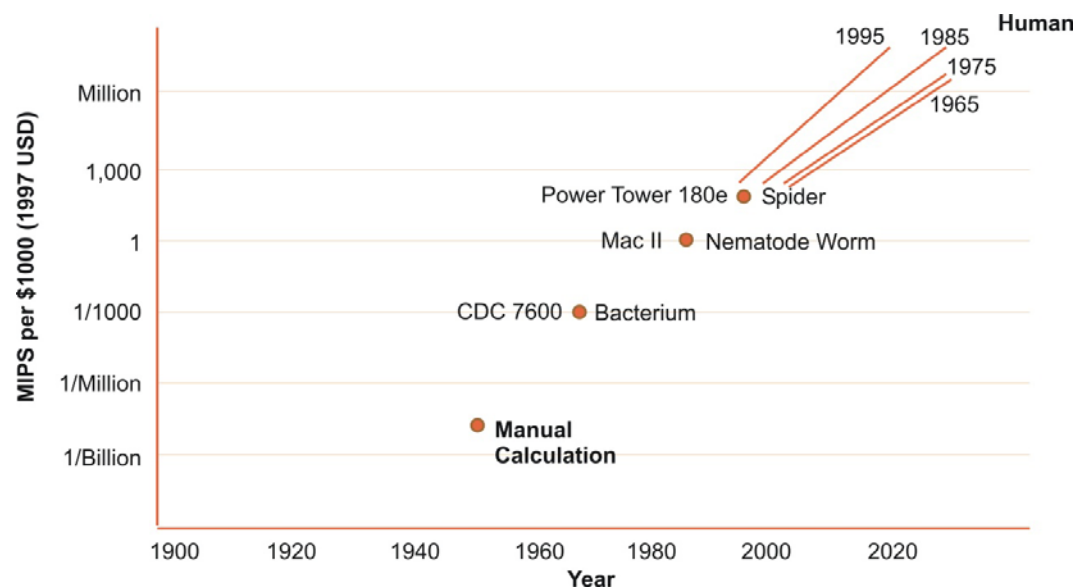


Figure 2.6. Matching brain power (Moravec 1998)

As shown above, in the 70's the processing power of a CDC 7600 computer matched that of a bacterium, in the 90's the Mac II matched a worm and in the 2000's a Power Tower 180e computer matched the processing power of a spider. The lines indicate the trends towards matching the processing power of a human brain calculated from 1965 to 1995. It is noticeable how in each decade the trend became steeper. The chart also highlights the vast difference between our capacity to perform manual calculations and the power required to simulate the human brain (100 million MIPS).

2.6 TECHNOLOGY AND SOCIETY

Technology is changing the way we communicate, work and entertain ourselves, as much as transforming the way we do almost everything, in a fashion that is modifying our society. Human society is evolving due to the merging of information and knowledge in the form of various technologies, which have affected our value systems, power structures, everyday routines and environment (Linturi 2000).

“Technology and society are inseparable”, they are in constant interaction and influence each other. The former “impacts, shapes and redefines society”, and the latter affects the development of technology, its implementation and diffusion (Surry and Farquhar 1996). Therefore, and although technology is developed to serve a social function (Segal 1994), our current social environment is a consequence of technology. Proof of this are the impacts that technological revolutions defined as an “accelerating and unprecedented technological change”, have had in the course of our history (Castells 1996).

Before the first Industrial Revolution, China was a dominating culture for most of the pre-Renaissance history; after 1492 the Spanish empire was a world power for over two centuries. The Muslim Moorish civilization dominated the Mediterranean and influenced Africa and Asia. However, after the first industrial revolution, and because of it, the western world (Anglo-Saxon/Germany and France) was in undisputable supremacy between the 1750s and the 1940s. *“Technology introduced a new historical path in the second half of the eighteenth century” (Castells 1996).*

Historians sustain that there were at least two industrial revolutions. The first revolution was characterised by the steam engine and the replacement of hand-tools by machines, and took place during the last third of the eighteenth century. The second, approximately 100 years later, featured the development of electricity, the internal combustion engines, and the beginning of communications technologies. It is important to note, however, that the fundamental scientific knowledge required for the first Industrial Revolution was available 100 years earlier, but the social conditions were not mature enough (Castells 1996).

In the Industrial Revolution a sudden and unexpected surge of technological applications transformed processes, created new products and shifted wealth and power to those who mastered the new technological system. A set of macro-inventions prepared the ground for the development of micro-inventions that created fundamental and irreversible historical discontinuity (Castells 1996). On the other hand Behling and Behling (1996) argue that whilst the new technologies of the industrial revolution allowed architects and builders to transcend the limitations of human scale, buildings started to surrender to the control of technology itself rather than using technology as a tool for architecture.

The Industrial Revolution set the basis for the Information Technology (IT) Revolution, and both have many similarities in the way they evolved and impacted our world. However, what characterises and differentiates the IT revolution is the application of knowledge and information to knowledge generation and information processing-communicating devices in a cumulative feedback loop between innovation and the uses of innovations. That is, users and doers became the same because information technologies are not simply tools to be applied, but also processes to be developed (Castells 1996). As noted by Kurzweil (2005) the Industrial Revolution extended the reach of our bodies, the IT revolution the reach of our minds.

New forms of social and technical division of labour were introduced by the IT Revolution. Whilst the transformation of manufacturing started during the 1980's through the development of microelectronic-based machinery, it was not until the 1990's that networked computers transformed the information-processing activities of the services sector. IT replaces repetitive and routine tasks that can be encoded in a programmable sequence, yet it is unable to do work that requires analysis and decision at the level that the human brain can (Castells 1996). Still, this level of mechanisation has been enough to transform the office work and with that our society. *“The mechanisation of office work is an essential element of the transformation of American society to one in which information*

work is the chief economic activity" (Giuliano 1985). As noted by Martino (2001) in Australia the increasing use of technology is dramatically changing the way people live and work. Further, office automation has gone from task rationalisation – as in batch-processing automation – to process rationalisation. Therefore, office workers can be now functionally integrated instead of being organisationally distributed (Giuliano 1985).

2.7 THE OFFICE

Giuliano (1985) defines an office as a place where people read, think, write, and communicate; where proposals are considered and plans are made; where money is collected and spent; where business and other organisations are managed. If technology is changing the way we perform such activities, the office needs to change in the nature and organisation of office work.

Marmot and Eley (2000), refer to the diversity of meanings that the word '*office*' can have. It can mean the organisation to which a person belongs in his/her work role, or the building itself, or just a small room (e.g. cubicle). Office can also refer to the people within an organisation. The Collins dictionary (2004) defines office as: 1) "*a room or set of rooms in which business, professional duties, clerical work, etc., are carried out.*", 2) "*the building or buildings in which the work of an organization is carried out*", 3) "*the group of persons working in an office*" it can also refer to an organisational structure 4) "*a subdivision of such an agency or of a department*".

Brill *et al.* (1984) define an office as a tool to organize work flow, support individuals at their tasks and send important messages through their design to workers, visitors and clients (both current and prospective).

2.7.1 History

Office work, that is collecting, ordering, manipulating, and passing on of information, in a place called office is a recent phenomenon. The idea of bringing a number of people together in one place to work on information would have puzzled a fifteenth-century craftsman, as would a nineteenth-century factory. However, by the year 2000 there were in the US alone 50 million office workers occupying an area of 1 billion m², which represents a capital investment of US\$ 10,000 billion. In the case of the UK, in that same year, there were 10 million office workers, occupying 200 million m², with a capital investment of US\$ 200 billion (Marmot and Eley 2000).

In Australia, the construction of offices accounts for the highest value of non-residential building work in the 2004-05 period and the second highest (below Retail/wholesale trade) in the 2005-06 period, refer to Table 2.3.

Technology has played an important role in congregating people to form what we know as today's office. Whilst equipment such as adding machines, typewriters, telephones, etc. made people's jobs easier, their size and cost make it necessary for them to be brought together in places where the technology could be used and shared (Marmot and Eley 2000). This need for congregation gave birth to the office building.

In 1900 Bolton wrote "*In lower New York City there are about sixty-five buildings, each exceeding 200 feet in height, devoted exclusively to office accommodation. The existence of such extended structures appears, in the case of this city to be due to legitimate causes, and*

the popular demand for the facilities, convenience and comfort which they offer, is increasing” (Bolton 1900).

Table 2.3. Value of non-residential building work done in Australia (ABS-1301.0 2008).

| | 2004-2005 AUD\$M | 2005-2006 AUD\$M |
|--|---------------------|---------------------|
| Commercial | | |
| Retail/wholesale trade | 3,942 | 4,815 |
| Transport | 625 | 632 |
| Offices | 4,047 | 4,756 |
| Other commercial | 102 | 127 |
| Total | 8,716 | 10,330 |
| Industrial | | |
| Factories | 1,364 | 1,278 |
| Warehouses | 1,863 | 2,585 |
| Agricultural/aquacultural | 145 | 163 |
| Other industrial | 209 | 246 |
| Total | 3,581 | 4,272 |
| Other non-residential | | |
| Educational | 2,331 | 2,910 |
| Religious | 126 | 185 |
| Aged care facilities | 912 | 936 |
| Health | 947 | 966 |
| Entertainment and recreation | 1,340 | 1,497 |
| Accommodation | 1,062 | 1,280 |
| Other non-residential | 989 | 1,249 |
| Total | 7,707 | 9,023 |
| Total non-residential building work | 20,021 | 25,245 |

Until the late 19th century, the height of office buildings did not exceed five stories. However, that changed. Office buildings as we know them, tall buildings located at prime locations, have their origins in large urban areas like New York City and Chicago, where city land prices were high and companies were competing for central locations. From a financial point of view there was the incentive to build taller buildings as they use less land per m² of office space. According to the Museum of Modern Art, Early Modern Architecture, the land price at the Chicago Loop district in 1880 was US\$130,000 per quarter acre, ten years later it rose to US\$900,000. Whilst several technological developments, like fireproofing, foundations and self-supporting metal frame construction needed to mature in order to give birth to high office buildings, two factors were the key determinants: 1) the cost of steel and 2) the elevator (Officemuseum 2005).

Although the cost of construction per floor initially decreases with the height of the building due to the shared foundations and roof, the cost then increases with the requirements of the structure to support it. Buildings higher than six stories cannot rely on brick walls for structural support as the thickness of walls in the lower part of the building increases the construction costs and reduces usable internal space. Therefore, a tall building must rely on a load transferring skeleton to carry its weight. However, this was not financially viable until the price of steel frame construction declined when the price of steel dropped from US\$166 per ton in 1867 to US\$24 per tonne in 1895 as per the 1896 Annual Statistical Report of the American Iron and Steel Association (Officemuseum 2005). Back then the steel skeleton of a 15 to 18 story office building weighted 1,800 to 2,200 tons (Bolton 1900), which meant that

the cost of the steel, material only, required for the structure of such a building in 1867 would have been on average US\$332,000 compared to only US\$48,000, 28 years later.

The other factor restraining the height of the buildings was the problem of moving people vertically. In fact, prior to the development of the elevator, the market value of the space declined with the vertical distance from the street as people needed to walk up and down stairs to access it. Although Elisha Otis installed a steam passenger elevator with a safety brake in a five-storey department store in 1857, it was not until 1874 that Otis Elevator Co. began producing hydraulic elevators. As a consequence of the development of elevators the price market of taller storeys changed as companies started to pay significantly more for space in higher storeys, away from the noise and dust of the street. In 1904 the electric gearless traction elevator machines became the standard for 44 years and an essential part of an office building (Officemuseum 2005).

In 1892 the Masonic Temple, with 20 storeys and rising 92m above the ground in Chicago, IL, was the highest office building in the world (Officemuseum 2005). In October 2003 Taipei 101 attained its full height of 508 meters. This structure houses office space for 12,000 people, a shopping mall and stock exchange. Its elevators can travel at 37 mph, taking passenger to the 90th floor in less than 39 seconds (ABC 2003). However, on the 27 of July 2008 Burj Dubai, still under construction, reached 160 completed floors (681.7m), making it the tallest structure of any type (including radio masts) ever built. By its expected completion in September 2009 Burj Dubai will have a total height (including antenna) of at least 818 meters (Wikipedia 2008a). Note, however, that efficiency decreases with height as net rentable area decreases because more elevators are required to serve higher floors.

2.7.2 Technology shaping the office environment

There literature identifies three major technology developments shaping today's office environment and modern society: the typewriter, the computer and the Internet. Below is a review of these technologies. Section 2.11 *Developing technologies* reviews new technologies likely to further transform workplace architecture.

2.7.2a The typewriter

Whilst there were a few dozen writing machines in existence back in 1850, the steel nib had not fully replaced the quill pen. It was not until the development of precision manufacturing techniques developed by Colt and Remington for the manufacturing of pistols and rifles that the typewriter could be produced in large numbers (Giuliano 1985). However, others believe that it was not a technological problem that saw typewriters develop 400 years after Gutenberg's printing press. After all, clocks developed back then had a mechanism more complex than typewriters. They believe that there was no need for typewriters in a world where cheap clerical labour was abundant and machines expensive. This theory is consistent with the birth of the mass production of typewriters taking place in 1873 in the US, which was at that time an underpopulated region where labour was scarce (Type writer museum 2005).

By the 1890's dozens of companies were manufacturing typewriters of diverse designs. By 1900 more than 100,000 typewriters had been sold and more than 20,000 new machines were being built each year. Around that same period, Morse's telegraph, Bell's telephone, Edison's dictating machine, together with the typewriter, started revolutionising the office environment (Giuliano 1985).

The evolution of typewriter usage can be compared with the usage of office computers and small PCs. The use of typewriters increased not only the number and size of offices and the variety of their jobs, but the social structure of the office. Due to this office mechanisation, a large number of women were employed in a previously male dominated environment. In 1955 the odds were that someone working at an alphabetic keyboard device was female (Giuliano 1985). Christopher L. Sholes, inventor of the first production typewriter, was portrayed as the saviour of women because the typewriter gave them jobs in offices which eventually translated into *“economic power, an equal position in the labour force and a voice in business”* (Type writer museum 2005). The association of females working with keyboards, especially at a secretarial level, became so strong that it was one factor that slowed down the adoption of computers at managerial levels later on.

The first half of the twentieth century experienced a refinement of existing and development of office technologies like the teletypewriter, automatic telephone switching, the electric typewriter, duplicating machines and copiers, calculators, tape recorders for dictation, offset printing presses (small enough for office use), and data-processing equipment operated with punched paper cards. Due to the increased office communication fostered by these technologies there was a fast expansion in the number of people engaged in white-collar work (Giuliano 1985). The term *‘white-collar’* was coined to make a distinction of those people working in industrial factories, usually wearing blue overalls, *‘blue-collar workers’*, and those at offices which soon became to be known as *‘paper factories’*, usually wearing white shirt collars (Marmot and Eley 2000).

2.7.2b The computer

‘Colossus’ was the world's first programmable, digital, electronic, computing device and it was used by British code breakers to read encrypted German messages during World War II (Wikipedia 2008). However, it was not until mid-1960's, 20 years later, that large businesses started using computers to do *‘back office’* tasks like storing payroll data and issuing cheques, controlling inventory, etc.

Peitchinis (1983) identified the initial high cost of computers as a barrier of adoption and notes:

“Despite price declines, a switch to microelectronic/telecommunications based technology is expensive, compared to traditional office equipment. While a word processor can be purchased for \$10,000 to \$20,000 depending upon the software, a conventional electric typewriter can be purchased for \$1,000.

In a sector where investment per worker has traditionally been low, it becomes especially difficult to justify a switch to technology which is expensive relative to the current office technology, and essentially unproven in actual office environment.”

By the end of June 1994, less than half of the businesses in Australia (49%) had computers, but by June 2002, 84% and by 2006 89% of businesses had computers. It is important to note that the proportion of Australian businesses making use of IT increases with employment and income size. By June 2003, 100% of businesses with 100 or more employees used computers, whilst only 78% of businesses with less than 5 persons used computers (ABS-1377.0 2003; ABS-8129.0 2006).

2.7.2c The Internet

With the increased adoption of computers, the need to connect them to other computers became apparent and so networks began, from small Local Area Networks (LANs) to network of networks. Even though the technology that makes the Internet possible existed a decade earlier, and hypertext technology (which links text with other texts) dates from as early as 1965, Internet did not become public until the 1990s. In August, 1991 CERN publicised the new World Wide Web (WWW) project. The Web was invented by English scientist Tim Berners-Lee in 1989 (Wikipedia 2008b).

Together with computers, Internet has revolutionised the way businesses access and transmit information (e.g. web sites) and communicate (e.g. email). In June 1998 just 29% of businesses had Internet access and only 6% of them had web presence, by the end of June 2007, 87% of businesses had Internet access and 34% web presence. As previously mentioned above, the relationship between the company size and the level of technology adoption also applies. For example, by the end of June 2007 practically all businesses (99.9%) with 200 or more persons employed accessed the Internet, while 95% had a web presence. On the other hand, 84% of businesses with less than 5 persons employed accessed the Internet and just a mere 24% had a web presence ((ABS-1377.0; ABS-8129.0 2006; ABS-1301.0 2008).

The use of IT not only varies with the size of the company as seen above, but across industries as well. At the end of June 2007, the industries with the highest proportions of businesses with Internet access were '*Professional, Scientific and Technical Services*' and '*Information Media and Telecommunications*' (both 98%), whereas the lowest rate was in '*Accommodation and Food Services*' (68%). '*Information Media and Telecommunications*' also had the highest proportion of businesses with a web presence (65%), whilst the lowest web presence was within the '*Transport, Postal and Warehousing*' industry (14%) (ABS-1301.0 2008).

More detailed information on adoption of IT, used for the development of the research instrument, is offered in Chapter 4. Section 2.11.4 *Virtual worlds* reviews a specific use of Internet with the potential to considerably affect workplace architecture.

2.7.3 Office models

Giuliano (1985) states that "*new technology inevitably affects the organisation of work*" and identifies three stages of office organisation, each characterised not only by its technology but also by its style of management, personal policies, hierarchy of supervisory and managerial staff, standards of performance and human relations among the people involved in the office and their clients. Following are the three office models according to Giuliano: the pre-industrial, the industrial and the information age office. Note that '*industrial*' in this sense does not refer to classical connotation of '*industrial age*' (XIX Century). Instead it relates to the extent of industrialisation in office-based processes.

The **Pre-industrial office**, Figure 2.7 (left side of figure), depends on the performance of the individuals, without much benefit from machines. There is little systematic organisation. Each person works independently, physically moving around to retrieve a file. Individuals have different styles of work and human relations are important. Loyalty, understanding, and mutual respect are cornerstones to the company. The only way to overcome an increase in the work load is by hiring more employees.

The **Industrial office**, on Figure 2.7 (centre), is a response to the limitations of the Pre-industrial office and introduces the principles of work simplification, specialisation, and time-and-motion efficiency. It is essentially a production line. Work moves from desk to desk as parts move along an assembly line. Jobs are simple, repetitive and unsatisfying. The fragmentation of responsibility created bureaucracy and proliferation of paperwork. Workers do not know the overall task to which they are contributing. Errors are compounded but not fixed. Everyone has to work together during the same hours in the same office to sustain the flow of paper. Tasks are isolated and work performance measured in an attempt to maximize efficiency and output. Even personal interaction is standardised.

The **Information age office**, Figure 2.7(right), combines systems and machines to the benefit of workers and clients, but tries to maintain the values of the pre-industrial office. It exploits new technology, yet it returns to people-centred work rather than machine-centred work. The machine is paced to the needs and abilities of the person who works with it. Instead of executing a small number of steps repetitively for a large number of accounts, one individual handles all customer-related records. Staff reduction of as much as 50% is common. Information is updated as it becomes available, and there are no uncertainties related to the 'work in process'. Productivity is no longer measured by hours of work or number of items processed, but by customer satisfaction (Giuliano 1985).

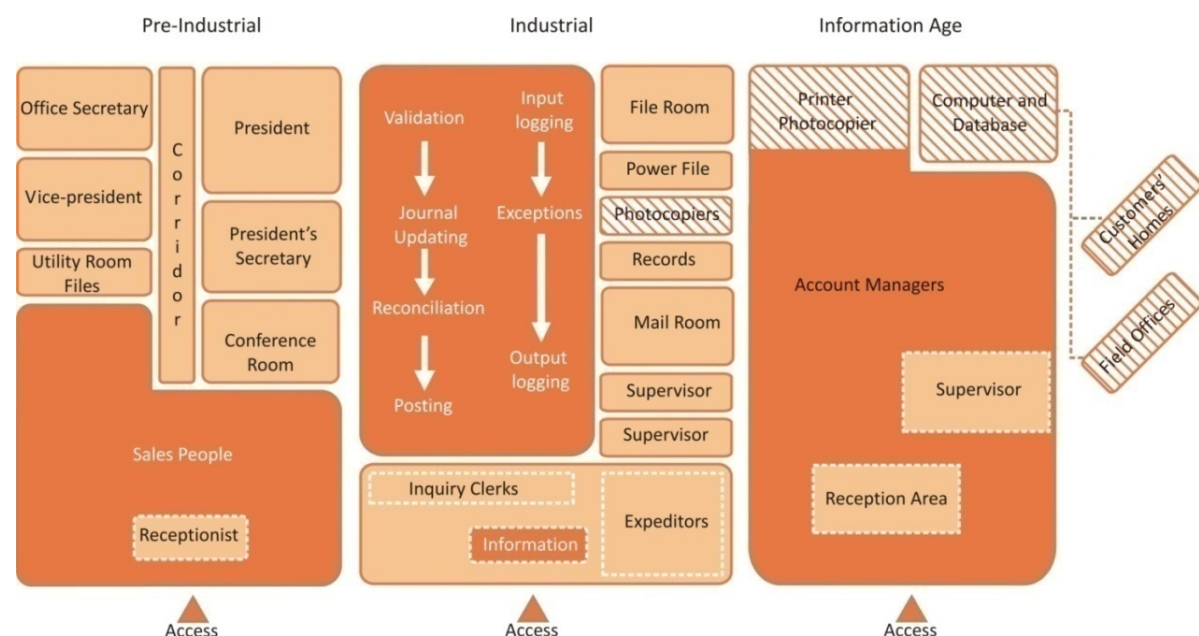


Figure 2.7. The pre-industrial, industrial and information age office (Giuliano 1985).

The rooms hatched on the Industrial and Information Age offices are rooms dedicated to host technology, or made possible only by communications technology – as in the case of the Customers' Home and Field Offices rooms of the Information Age office. Technology starts to claim physical space, but also blurs boundaries between geographic locations.

The Information age office as described above was Giuliano's vision in 1985, but as noted by the French poet Paul Valéry "*the trouble with our times is that the future is not what it used to be*". Today's vision of the information age office is more radical. In fact there is no office, at least physically. This is further discussed in section 2.11.4 *Virtual worlds* and Chapter 9.

2.7.4 Office types

Based on a unique combinations of architectural (spatial organisation) and functional (type of work) features Bodin and Bodin (2008) identified 5 office types drawn from Ahlin and Westlander (1991) and Duffy (1999). Table 2.4 summarises the specific architectural and functional features by office type.

Table 2.4. Office types (Bodin and Bodin 2008).

| Office type | Architectural features | Functional features |
|--|--|--|
| Cell office Single room office. | Rooms along the façade of the building offering every room access to a window; consequently, long corridors that connect small offices to each other. | Most of the amenities are found within the room. The office work is characterised by independence and is of concentrated nature. |
| Shared office Up to 3 people share a single room. This office type is often a consequence of lack of space. | Workstations are often freely arranged in the room, sometimes with screens or other divisional elements providing privacy at the individual workstation. Roommates share windows. | Most of the amenities are found outside the shared room office, except when used for team-based work. People sharing a room tend to have similar work assignments. The team-based shared room office is characterised by interactive project work. |
| Open plan office This layout is flexible to organisational change and handles changes without reconstruction. | Shared room with workstations that are often freely arranged in groups. Screens between different workstations reduce noise and provide some privacy at the individual workstation. | Sometimes amenities can be found at the individuals' workstation. Employees mainly work individually, on routine-based work and low levels of interaction. |
| Flex office No individual workstation. This is the most flexible office type, both furniture and employees are flexible. | Often an open plan office, though not a defining feature, the flex office includes ' <i>backup spaces</i> ' that enable concentrated work, private phone calls, meetings, and so on. Dimensioned for <70% of the workforce to be present simultaneously; based on expected illness and work outside the office amongst other. | Depends on good information technology to enable employees to choose workstation freely in the office as well as outside the office. Shared amenities in common spaces. No ability to personalise the workstation. |
| Combi office Employees spend >20% of their time at workstations other than their own. | No strict spatial definition, but contains individual workstations in either an individual room or an open plan office. There is access to ' <i>backup spaces</i> ' that enable work activities that cannot take place at the personal workstation, such as specific work functions, full-time project rooms, and meeting rooms. | Teamwork and the sharing of common amenities define this office type. The office work is independent in its character, as well as interactive with colleagues in teamwork. The teams move around in the office on an ' <i>as-needed basis</i> ' to take advantage of a wide range of common facilities. Shared work facilities in common spaces. |

Bodin and Bodin (2008) note that the above office types are broad categories as there are variations between and within them. They state, however, that cell office stands out as the clearest definition because all other office types mean sharing the workspace and amenities between employees to varying degrees.

Most contemporary workplace designs have an open plan layout. Furthermore, it is usually this characteristic that makes the environment feel contemporary. Nonetheless, open plan is at least 116 years old (as at 2009). Figure 2.8 shows the main Office of the Home Office Building, National Fire Insurance Co. of Hartford, in the US, built in 1893 (office museum 2005).



Figure 2.8. Home Office Building, National Fire Insurance Co. of Hartford, CT, 1897 (office museum 2005).

The above open plan layout is not too different from recent layouts design, see Figure 2.9.



Figure 2.9. Contemporary office layouts (Geyer 2009, eins:eins Architekten 2009).

The above figure shows on the left side the Westpac Business Banking located in Sydney, Australia designed by Geyer (Geyer 2009), on the right side the offices of Syzygy in Hamburg, Germany designed by eins:eins Architekten (eins:eins Architekten 2009). The similarity (rows of desks on an open plan) between Figure 2.8 and Figure 2.9 is apparent.

The New South Wales Government Workplace Guidelines states that *“organisations like open plan offices because they tend to be smaller and thus cost less on a per employee basis (because density is higher). They may also be more flexible”* (NSWGWG 2009). On this

guidelines, Becker and Sims (2000) are quoted: *“work environments that are more open create more opportunities for observing and learning from those with more experience and different skills”*. Parallel, Monaghan (2009) highlights the financial advantages of open-plan offices and notes that *“walls cost money and, combined with separate lighting and air conditioning, individual offices could cost 20% to 25% more than an open-plan format”*.

The above seems to make a case for open plan layouts. However, Bodin and Bodin (2008) used the office classification as per Table 2.4 to test the hypothesis that *“office type has an influence on workers’ health status and job satisfaction.”* Their research, based on Swedish offices, produced the following results:

- Overall, the cell office and flex office were associated with better self-reported health.
- Shared room offices, and small and medium-sized open plan offices were found to be inferior office types with respect to general health, and small and large open plan offices were inferior with respect to physical and psychological problems.
- The flex office, together with the shared room office and the cell office, was rated to be the best office type in terms of job satisfaction.
- Inferior results were found for all open plan offices and the combi office, although the latter showed high satisfaction with respect to cooperation.

Bodin and Bodin (2008) believe that their results show that office type correlates to health, well-being, and job satisfaction among employees. They note, however, that the self-reported health status and job satisfaction of employees is mainly influenced by factors such as age, gender, and job rank. For instance, women tend to report poorer health status and also to have higher sick leave rates. Thus, in the statistical analysis the researches adjusted for the influence of these three background factors, as well as for the influence of the line of business in which employees worked.

Bodin and Bodin (2008) attribute the good results in terms of health, well-being, and job satisfaction among employees in cell offices and flex offices to be most likely because of their ability to meet the need for personal control. They also found support in the work by Lee and Brand (2005) who found that more personal control over the physical workspace increased job satisfaction. These needs are more easily satisfied in cell offices and flex offices compared to other types of offices (Bodin and Bodin 2008).

Whilst the flex office does not offer the opportunity to personalise the workstation, Bodin and Bodin (2008) note that it allows workers to choose their workstation according to personal preference or work tasks. It also gives the workers the opportunity to mix with different colleagues when they so wish and offers easy access to *‘backup space’* for meetings.

Oommen *et al.* (2008) examined textbooks and journal articles in relation to various issues that affect employees in an open plan work environment and found that 90% of the literature suggested that working in an open-plan office was seen as negative. Their literature review identified that open-plan offices caused high levels of stress, conflict, high blood pressure, and a high staff turnover. The high level of noise causes employees to lose concentration, leading to low productivity. There are privacy issues because people can see what others are doing on the computer or hear what they are saying on the phone, which creates a feeling of insecurity (Oommen *et al.* 2008).

Dr Oommen was quoted in a recent interview:

"The evidence we found was absolutely shocking... I think employers around the country need to rethink the open-plan environment in their offices... The research found that the traditional design was better - small, private closed offices."

Dr. Oommen (News 2009).

Oommen *et al.* (2008) suggest managers to have a better understanding of open plan work environments before embracing such workplace designs. Further, they recommend a multidisciplinary approach when decisions are being made in relation to which type of environment is better suited to the requirements of their employees as this has an impact on workforce productivity and job satisfaction.

2.8 THE OFFICE OF THE FUTURE

Since 1964, when IBM introduced a magnetic-card recording device into a Selectric typewriter, the future of the office, but most of all our expectations of it, changed forever. However, and although technology, even that of the 80's, would have allowed us to have a *"paperless, push-button, electronic world where high finance meets high technology in a triumph of white collar productivity"* (Immel 1985), today most offices are far from achieving this goal. In May 1983 the magazine Popular Computing conceded *"progress towards the office of the future has been slower than many expected"* (Immel 1985). The long wait together with the high expectations set for the office of the future have created disbelief that technology will change the white collar or information worker's environment as predicted. After all, predictions of office environments *'rarely hit the mark'* (Dowdy 2000).

Vallee (1982) beautifully describes the emotions and expectations surrounding the office of the future. Moreover, he identifies the key role that people play in the so called *'office of the future'*. His remarks that technology is not the problem, but its implementation, and the people, are still valid today (more than 25 years later). Following is an extract from Vallee's book illustrating this:

"'Tell me, then, what you think of the...' There Dr Breeze paused, took a long breath, and puffed himself up to say in a stentorian voice, the Office of the Future?"

'There isn't going to be an Office of the Future.'

'Oh!' Said Dr Breeze in mock astonishment. 'You must not let anyone hear such words.' Blushing, he went to the door and closed it carefully, after looking to the left and to the right to make sure no one had heard my statement. When he came back, he spoke low, in conspiratorial tones.

'Who are you, some kind of anarchist? Everybody is working on the Office of the Future, everybody is investing in it, and now you're saying it isn't going to exist. They'll kill you if they find out.'

But there was a twinkle in [Dr Breeze's] eye that encourage me to go on.

'If what you call an office is a square room with telephones and typewriters in it, then I agree with all the companies like Xerox and IBM that are building word

processors and duplicators and voice recognizers and other electronic whatnots to expand their capabilities. That particular office of the future is going to happen of course. Whether we like it or not.'

'So what are you worried about?'

'I just don't think it's that simple. An office has people in it, you see. They have lives and ambitions and needs and emotions. They interact. Most of the 'productivity' everybody talks about comes from the interaction, not from the ability to write and process pieces of paper. And those machines will do nothing for the people interaction. So the benefits from having all that hardware may not happen for 10 years, or 20 years ...'

'And when they do happen?'

'By then other things will have change drastically under pressures of the technology. So the real problem is much larger than making offices more productive. The real problem is to decide right now what human qualities and freedoms are worth fighting for and which ones are not. Because when we are through with this digital transformation there won't be a stone left standing on another stone of our social edifice. There may still be a future, but there won't be an office to put in it.'

2.8.1 The myths of the office of the future

Due to the feeling of technology domination felt after the post-industrial innovations (1960's – 1970's) it was believed that offices in the future, that is today, would be run by robots whilst workers would enjoy free time (Dowdy 2000). This belief was so strong that it worried social scientists about the vast amount of leisure time the workforce would have to manage and ignited the fears of a jobless society (Castells 1996; Spreckelmeyer 1999).

However, in Japan, 2002, there were 160 official cases of '*karoshi*', death from overwork, and 43 more people committed suicide because of overwork. The French government is assessing lengthening its 1998 workweek arrangement (Tischler 2005). Even Spain's proud '*siesta*' is threatened by today's working habits (Pogash *et al.* 2005). In Australia, according to the Australian Bureau of Statistics, the number of employees who work overtime on a regular basis increased to nearly 3 million in 2003. Of these, 38% were paid for the overtime, 21% had overtime included in their salary package, and 33% were not paid for the overtime.

According to a Citigroup global energy investment banker "*expecting 90 to 100 hours a week is not at all unusual*". Technology seems to be playing an opposite role to the one forecasted back in the 60's and 70's. A Los Angeles litigation associative which billed 3,060 hrs in 2003 says: "*You can do billable hours whilst travelling on the San Diego Freeway. It is a way to be productive in an otherwise unproductive time.*" (Ward 2005). We have become slaves of technology. Still, there are other factors like globalisation, competition and global trends of corporate downsizing that are forcing staff to work at different time zones and to bear the load of fallen colleagues. The consequences are, according to the Human Capital Institute, that "*the 40-hours workweek is a bit of a myth now*" (Tischler 2005).

The SUSTEL project (2004), discussed in more detail in section 2.9.1a *The SUSTEL Project*, shows that a large number of teleworkers across 5 European countries reported an increase in working hours in the last two years of the study, especially UK-BT, refer to Table 2.5.

However, the study cannot distinguish if teleworking is the cause of increased working hours or a generalised phenomenon.

Table 2.5. Time spent working in 5 European countries (SUSTEL 2004).

| | Denmark | Germany | Italy | Netherlands | UK – BT ¹ | UK-BAA ² |
|-----------------|---------|---------|-------|-------------|----------------------|---------------------|
| Increased | 23.4% | 41.2% | 38.5% | 56.5% | 75.7% | 38.9% |
| Stayed the same | 76.6% | 54.4% | 42.3% | 30.4% | 18.3% | 50% |
| Decreased | - | 4.4% | 19.2% | 13.0% | 5.9% | 11.1% |

Table 2.6 reports the additional working hours per week for respondents that reported an increase of working hours in the above table.

Table 2.6. Additional working hours per week (SUSTEL 2004).

| Hours/week | Denmark | Germany | Italy | Netherlands | UK – BT | UK-BAA |
|------------|---------|---------|-------|-------------|---------|--------|
| 0-5 | 72.7% | 78.6% | 50% | 38.5% | 29.1% | 71.4% |
| 6-10 | 27% | 21.4% | 40% | 46.2% | 40.2% | 28.6% |
| 11-15 | - | - | - | - | 15.4% | - |
| 16+ | - | - | 10% | - | 11% | - |

Nevertheless, the above seems not to be the case across the board; it is more applicable to certain types of jobs like investment banking and management consulting. The Bureau of Labour Statistics in the US says that only about 17% of managerial workers worked more than 60 hours a week in 2004 (Tischler 2005). Further, the average hours of production of nonsupervisory workers on private nonfarm payrolls by major industry sector, have declined when compared to 1964, refer to Figure 2.10, based on US Employment and Earnings from 1964 to 2004 (Tischler 2005) .

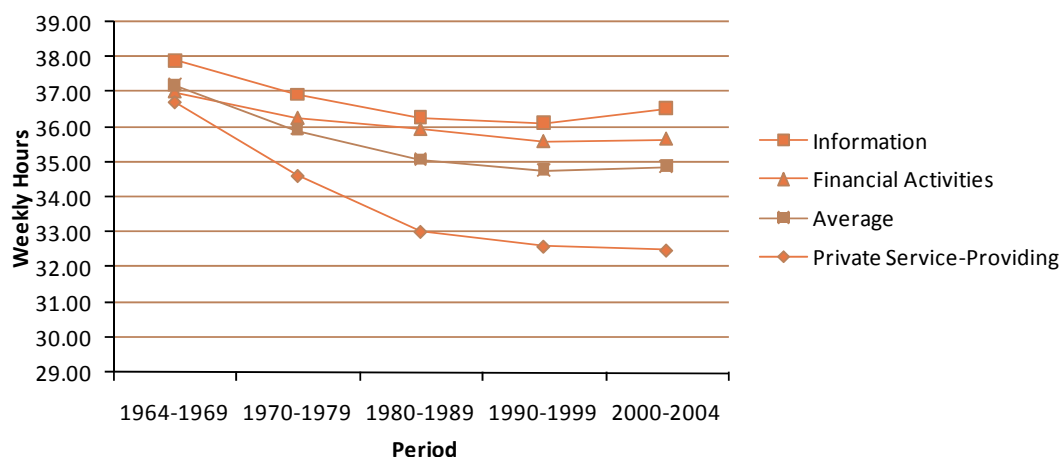


Figure 2.10. Working weekly hours analysis (1964-2004) in the USA (Tischler 2005).

¹ UK-BT = United Kingdom – British Telecom

² UK-BAA = United Kingdom – British Airport Authority

Another office of the future myth is the so called '*paperless office*'. Since 1975 this concept represents not only the idea of pure information crossing digital networks, but tangible benefits for reducing deforestation and reduction of up to 40% of solid waste. However, despite unforeseen technology advances since 1975, the paperless office seems like a myth (Brown 2000).

In 1975 the annual paper consumption per person in offices was less than 45 kg, but by the end of the 1990's was more than 90 kg. In 1998 paper companies outperformed the high-performance Dow. In the 1990's despite the effort of companies like Aetna, which claims it has reduced 100 million pages annually, the consumption of paper grew from 87 million to 99 million tons per year. "*The appearance of information technology seems to have accelerated the use of paper, not diminished it*" (Brown 2000). The advent of e-mail has increased office paper use by 40%, the more information people receive and have access to, the more people need to print it. In fact, information and knowledge workers use three times more paper than the average office worker (Reid 2003).

In 2002 we stored about 5 exabytes of new information on paper, film, optical, or magnetic media. As described by the New York Times such figure is equivalent to the sum of every word ever spoken by humans since the dawn of time (Swartz 2004). In "*How much information?*", a study done by UC Berkeley's School of Information Management and Systems, an estimated of 3 billion archiveable pages are generated by US companies per year. Based on the US figures the researchers made an educated guess that each year the world produces 7.5 billion archival pages. That same study established that 200 pieces of paper requires 1 cubic foot (0.028 m³). Therefore, a space of 267,857,142,857 m³, that is 267.86 billion m³ are required every year to host such amount of paper. As a comparison, and requiring considerable less space, that same amount of information can be stored electronically using 195 terabytes (Lyman and Varian 2000).

According to Brown (2000), the reason why we cannot get rid of paper, and why so many attempts to do so, or at least reduce its use, have failed relies on a misunderstanding of what paper is. He describes paper as much more than "*a shell to be cast off now that information has reached maturity*". According to Sellen and Harper (2002) there are four qualities of paper that current technology cannot replace: tangibility, spatial flexibility, tailorability and manipulability.

Still, consulting companies are building expertise and offering solutions to help businesses reduce their paper consumption (Schmidt 2005). Offices are using Tablet PCs (laptops with touch screen that can be operated with a stylus) to take and store notes, which together with other efforts like document management systems have freed up storage space. Companies that have implemented such approaches have gained considerable space previously used as storage. Thanks to those efforts Mintz & Partners, a company in Toronto, transformed two file rooms into two offices (Colman 2005).

Another way to reduce paper consumption relies on applying alternative ways of working. The SUSTEL project (2004) reported that BT's teleworkers no longer required the '*security blanket*' of printed copies. A possible explanation on why 26.3% of the survey respondents reported a decrease in their printing of documents is as a result of teleworking.

There are parallel efforts focusing not in getting rid of paper, but to revolutionise it. E-paper, is a display technology designed to imitate the appearance of ordinary ink on paper. Unlike a conventional flat panel display, which uses a backlight to illuminate its pixels, e-paper reflects light like ordinary paper and is capable of holding text and images indefinitely

without drawing electricity, while allowing the image to be changed later (Wikipedia 2009b). Companies like Xerox are working on solutions like SmartPaper, which is produced in a roll, like conventional paper, but it is actually two sheets of thin plastic with millions of small bi-chromal beads embedded in between. Each bead is smaller than a grain of sand and has a different colour on each half that is charged differently (positive or negative). By turning them, rotating them, images and or text can be displayed (Gyricon 2005).

Plastic Logic is a spin-off company from Cambridge University's Cavendish Laboratory and specializes in polymer transistors and electronics (Wikipedia 2009). They have developed a reader that supports a comprehensive range of business document formats, such as Microsoft Word, Excel and Powerpoint, and Adobe PDFs, as well as newspapers, periodicals and books (plastic logic 2009).

2.9 ALTERNATIVE WAYS OF WORKING (AWW)

Alternative ways of working challenge what traditional schemes take for granted. Questions like: *do certain people need to come to the office? Does the office need to take a certain form? Can we do things differently and more efficiently?* are redefining the way we work by offering a new array of different working options (Marmot and Eley 2000).

Teleworking, hot-desking and virtual office are the most common AWW and are further discussed in sections 2.9.1 *Teleworking*, 2.9.2 *Hot-desking* and 2.9.3 *Virtual office*. Other alternative ways of working include (Marmot and Eley 2000; Stocks 1998):

- **Hotelling:** A pre-booked version of hot-desking. The facilities are provided by a 'concierge' to minimise downtime;
- **Motelling:** As hotelling, but with the distinction that no booking is required; which means that workers need to arrange the facilities on the spot;
- **Caves:** Flexible, partitioned areas for common use within an office;
- **Commons:** Open plan meeting rooms to encourage spontaneous get-togethers;
- **Cottaging:** Home workers gathering at a local work centre for interaction and access to technology;
- **Guesting:** Organisations using one another's office space; and
- **Just-in-time office:** A work area available to everyone as needed.

A study done in the UK by Actium Consult and Cass Business School (2005) suggests that alternative ways of working make financial sense. Figure 2.11 shows a breakdown of the office costs components and Figure 2.12 shows the proportional cost of each of these components. The latter illustrates that the cost of physical space, that is rent, is a major cost that can nearly represent 50% of all the office costs (Actium 2005). Therefore, considerable savings can be achieved if the amount of space required by each employee can be reduced or used in a more efficient fashion.

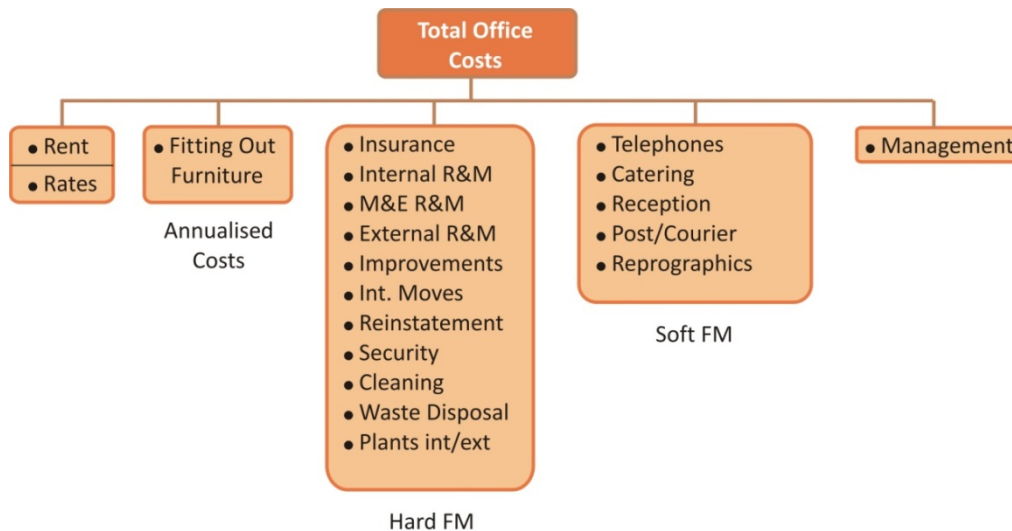


Figure 2.11. Total office cost breakdown (Actium 2005).

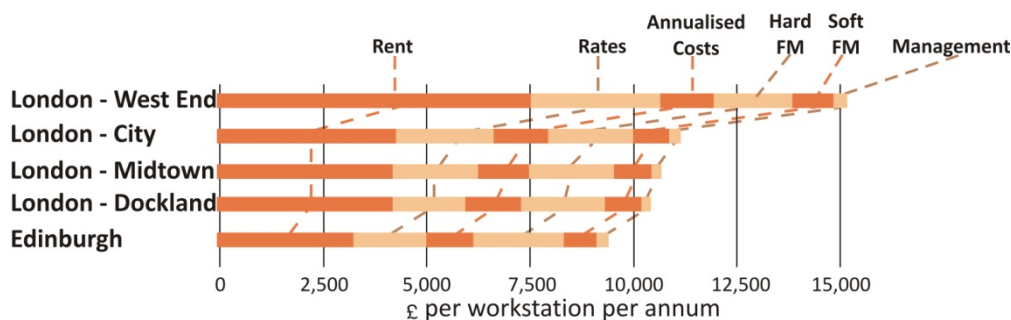


Figure 2.12. Office cost per workstation per annum by location (Actium 2005).

Actium (2005) claims that through flexible working a medium size business (500 staff) can make a saving of £0.77m per annum on property costs. However, flexible working alters the traditional ratio of 65% property costs, 35% IT to 55% property and 44% IT, the remaining 1% being the cost of change in management required to make the new environment work. Refer to Table 2.7 based on Actium (2005)

Table 2.7. Split of costs for a flexible working scenario (Actium 2005).

| Area | Percentage |
|---------------------------|------------|
| Occupation Property | 26% |
| Operations and Support IT | 24% |
| Hardware and Software IT | 20% |
| Operation Property | 12% |
| Business Support Property | 9% |
| Annualised Costs Property | 8% |
| Change Management | 1% |

Another incentive to adopt alternative ways of working is the environmental benefit. Companies implementing flexible working can reduce, or even eliminate, the need for

buildings along with the energy and resources required to construct and maintain them. Moreover, almost all studies of teleworking report a reduction in commuting travel (SUSTEL 2004). Such reductions are important as just one gallon of gasoline produces 19.64 pounds of carbon dioxide, responsible for global warming and climatological changes (AT&T 2005). However, *“in practice it is economics rather than environment which is the main driver.”* (SUSTEL 2004).

2.9.1 Teleworking

In 1990, the International Labour Organisation (ILO) defined telework as *“a form of work in which a) work is performed in a location remote from central office or production facilities, thus separating the worker from personal contact with co-workers there; and b) new technology enables this separation by facilitating communications.”* A shorter definition of teleworking is given by the UK Trades Union Congress: *“Distance working facilitated by information and communication technologies”* (Martino 2001).

Because teleworkers use data links from afar, some literature, especially that of the US refers to teleworking as telecommuting (Marmot and Eley 2000). Although in most cases teleworking and telecommuting are used as synonyms, Nilles makes the following distinction by defining teleworking as *“any form of substitution of information technologies for work-related travel”*, whereas *“telecommuters are generally employees of some organisation, as contrasted to people with home-based business”* (Martino 2001).

Jack Nilles, identified by the literature as the father of teleworking, describes offices as *‘information factories’*, where *‘information workers’* have to report in order to do their work. That has been the model for more than one hundred years. However, between 1973 and ‘74 using a real company of two dozen people as *‘a guinea pig’*, Nilles demonstrated that telecommuting could work. Nevertheless, he soon identified that the major challenge to successfully implementing teleworking was not technology, but people: *“A crucial extra ingredient to make telecommuting work is an attitude shift.”* Still, back in 1998, he predicted that by the end of the year 2000 there will be more than 23 million telecommuters in the US (Nilles 1998). As Table 2.8 shows, Nilles prediction was accurate. About 20% of the US workforce telework at home, at a telework centre or a satellite office, work on the road, or at a combination of work sites (Langhoff 2005).

Table 2.8. Growth of telecommuting in the US 1990 to 2004 (Langhoff 2005).

| Year | Millions of teleworkers |
|------|---|
| 1990 | 3.4 |
| 1994 | 9.1 |
| 1997 | 11.1 |
| 1998 | 15.7 |
| 1999 | 19.6 |
| 2000 | 16.5 employed telecommuters, 23.6 teleworkers (work-at-home and occasional telecommuters) |
| 2001 | 28 |
| 2003 | 23.5 employed teleworkers plus 23.4 self-employed teleworkers |
| 2004 | 44.4 (24.1 employed teleworkers plus 20.3 self-employed teleworkers) |

Teleworking seems to be becoming a global trend. In 1999, the European Electronic Commerce and Telework Trends (ECaTT) consortium measured the size of the teleworking

population in 10 European Union member states. The result was, that on average, 6.1% of the labour force was engaged in teleworking, with countries like Finland and Sweden registering 16.8% and 15.2%, respectively (Gareis and Kordey 2005).

Australia has been involved in teleworking since the mid 1980s, or even for more than half a century if the outback radio communications system is considered. Prior to 1998 Australia was well below its forecast potential, yet it recovered lost ground and reached values forecasted by 1998. *"Quite possibly future growth will be at or even above the nominal growth curve"* (Nilles 1999). According to Martino (2001) a quarter of the Australian working population could be teleworking and because of its large geographical area and underpopulated regions, it appears to have a natural interest in teleworking.

In 2004, the Australian Government established the Australian Telework Advisory Committee (ATAC), a taskforce set to advice on options and impediments to the development of telework for employees and businesses. ATAC had its final meeting on February 2006 at which it recommended the Government to encourage the growth of telework. Below is a list of teleworking benefits identified by ATAC (2009):

- **Recruitment and retention:** Telework reduced avoidable staff turnover by over 20%.
- **Productivity:** Managers reported that employees were between 8% and 40% more productive.
- **Office space:** Savings of up to 80% were reported.
- **Absenteeism:** Telework reduced avoidable absenteeism by up to 80%.
- **Morale:** Improvements of 80% were reported in some organisations.
- **Office costs:** The costs of heating, air-conditioning, car parks, lighting and more, can drop by 17% of salary costs.
- **Sustainability:** Telework also has the potential to reduce traffic congestion and emissions and reduce energy consumption.
- **Work life balance:** Telework better supports employees' work life balance.
- **Other:** Other benefits include improved information access, time savings, improved communications, increased sales, more face-to-face contact with clients and easier contact with employees.

Teleworking enables organisations to make more effective use of space and can reduce overall demand for buildings. In a study by SUSTEL (2004), 12 out of 30 companies needed less office space as a result of telework, and an additional three were expecting such benefit in the near future. Further, in the case of Word Association, a UK company, teleworking allowed them to close their central office.

A study by the UK Royal Institute of Chartered Surveyors revealed that British businesses were wasting up to €25 million a year through inefficiency in their use of property. That same study concluded that an office space optimisation program could free up space which could be used to ease the housing shortages in London and surrounding areas (SUSTEL 2004).

The advantages of adopting teleworking models are many, including benefits to the environment, cities, companies and individuals. Teleworking helps reduce the need for roads, which due to economic and space constraints cannot follow the increase of population (Nilles 1998). It can also yield employers annual savings of US\$5,000 per employee (ITAC 2004).

However, teleworking is not easy to implement. A relationship of trust between manager and managed needs to exist before attempting telecommuting. Doing so is challenging as there is often significant resistance to changing the all too common adversarial relationship between the two parties (Nilles 1998). The following interview made by Charles Handy to an Atlanta Journalist best illustrates this (Marmot and Eley 2000):

Question: "Do you not work at home, at least for some of the time?"

Answer: "Never. Of course, I could do much of my stuff there."

Question: "So why don't you?"

Answer: "They won't let me."

She pointed to the end of the room where, behind two large glass windows, sat the two deputy editors. "They like to have me where they can see and shout at me."

Another problem is the strong role that the physical office still plays. Giuliano (1985) describes the attributes of a physical office as home for organisations, a place to meet face to face, and a work-oriented environment away from home. The following response on working from home from a management consultant exemplifies the desire of some people to maintain boundaries between home and office:

"I view my home as somewhere in which the company doesn't intrude. I would not like to work at home; I like to keep home and work separate. I've got everything I need in the office, and I've got the people I need in the office. The remoteness of the home situation means I'd miss out on a lot of the informal side of things. I like the discipline"

Marmot and Eley (2000)

2.9.1a The SUSTEL Project

The SUSTEL project is one of the most important researches done on teleworking. Whilst some of its results have been discussed in previous sections, the following is a short summary of the project.

Financed by the European Commissions' IST initiative, the SUSTEL project was a research on teleworking undertake from 2002 to 2004. The project started by identifying aspects of the relationship between teleworking and sustainable development, which involved assessing its economic, environmental and social impacts. The project is based on 30 case studies and a survey of teleworkers in 6 organisations in 5 countries to answer its 27 research questions (SUSTEL 2004).

SUSTEL found that teleworking was economically beneficial in most, but not all, of the cases. Refer to Table 2.9.

Table 2.9. Economic impacts of teleworking (SUSTEL 2004).

| | |
|------------------------|---|
| Added Value | Better work performance, less absenteeism, and improved recruitment and retention were reported. Mobile teleworking considerably cut office costs. However, poorly designed telework schemes can be financially negative. |
| Personal Wealth | Whilst there was an increase of energy costs for teleworkers (e.g. extra home heating) they were outweighed by savings in travel (the main financial benefit) and child care costs. |
| Resilience | Whilst staff overcome travel and other disruptions (e.g. weather), teleworking increases vulnerability to systems failures (e.g. Intranet failure). |
| Human Capital | Most felt that teleworking had a positive influence on their competencies and skills. However, the most important negative impact is the actual or perceived ' <i>invisibility</i> ', and therefore fewer development or promotion opportunities. |
| Employment | It was inconclusive if teleworking provides employment to disabled people and enables greater organisational efficiency and effectiveness. |

In reference to environmental impact of teleworking, SUSTEL found that transport rebound effects do not outweigh commuting saving and environmental benefits from more efficient use of offices can be considerable. Refer to Table 2.10.

Table 2.10. Environmental impacts of teleworking (SUSTEL 2004).

| | |
|-----------------------------|---|
| Transport | Teleworkers reported avoidance of congested periods and less travel. However, some teleworkers said they had to make special trips for activities previously carried out as part of commuting. |
| Air Quality | Reduced transport means fewer emissions which translate into better external air quality. Also, teleworkers were glad to escape ' <i>stuffy offices</i> '. |
| Resource Consumption | Teleworking substantially duplicates equipment (desks, computers, etc). Working at home increased heating, lighting, and other energy-consuming activities as a result of an increase by 21 hours a week or more in home occupancy. |
| Built Environment | Teleworking can reduce overall demand for office buildings which will considerably improve the environment. Mobile teleworking results in redesign of work spaces and, sometimes relocation. Negative impact on transport if flexible offices are not well located for public transport. Teleworking can also impact on the design and location of homes. |
| Safety | If the home or mobile environment is ' <i>riskier</i> ' than the office environment then changes in exposure will lead to lower safety. Some home based teleworkers have experienced poorer health and safety conditions at home than in the office. |

Finally, in the personal and social impact, SUSTEL found that on balance, teleworking was beneficial to most people and positive social impacts outweighed negative ones. Refer to Table 2.11.

Table 2.11. Personal and social impacts of teleworking (SUSTEL 2004).

| | |
|--------------------------|---|
| Social Inclusion | Teleworking helped disabled people and females on maternity leave to remain in employment. |
| Quality of Life | A large majority of respondents felt that they had a good or very good quality of life and that telework played a positive role. They reported better work performance and psychological benefits from greater control of personal time, reduced stress of commuting and the opportunity to spend more time with partners and children. The main negative factors are feeling unsupported, and missing the human interaction of an office. Up to 58% of survey respondents felt isolated from work colleagues, 75% of those answering in this way felt this was negative. |
| Work Life Balance | A large majority felt that it had been improved by telework. However, teleworkers often work longer hours, but apparently without negative consequences. |
| Health | Most felt teleworking had beneficial effects and teleworkers usually had fewer sick leaves than non-teleworkers. Influenced through changes in stress, diet, exercise, etc. |
| Community | Greater involvement in community activities and increased use of local services by up to 58.6% |

2.9.2 Hot-desking

Hot-desking is a term derived from ‘*hot bunking*’, a practice used to save valuable space in warships where a person coming off watch crawls into a shared bunk just vacated (still warm) by someone going out to do his shift. In workplace terms, hot-desking is the concept of two or more people sharing a desk by using it at different times. As in hot-bunking, an effective hot-desking program will not allow the chair to cool down for the other person to use it (Marmot and Eley 2000; Institute of Management Services 2001; Lake 2005).

Marmot and Eley (2000) highlight the importance of carefully analysing whether and when people use their assigned working space. Such analysis can show that desks can have a vacancy of as much as 80% during the working day. Whilst employees may be aware of this, such information “*is rarely translated into information bearing directly on the use of space.*” IBM undertook an investigation in the UK, Canada, US, Japan and Australia, based on the assumption that its sales force should not be in the office, yet doing ‘*face time*’ with clients. As a consequence, an active sales force would leave behind valuable and expensive office space. This also applies to other type of employees like consultants, journalists or anyone whose job keeps them out of the office more than in. Therefore an office, or a department within an office, will have unused space depending on its type of employees.

Figure 2.13 shows how different people use desks across the working day. In a ‘*Mostly in*’ office the typical ratio of desks to people should be 1:1, where as in an ‘*In and out*’ should be from 0.7:1 to 0.4:1 and in the case of ‘*Mostly out*’ the ratio should be around 0.3:1 to 0.1:1.

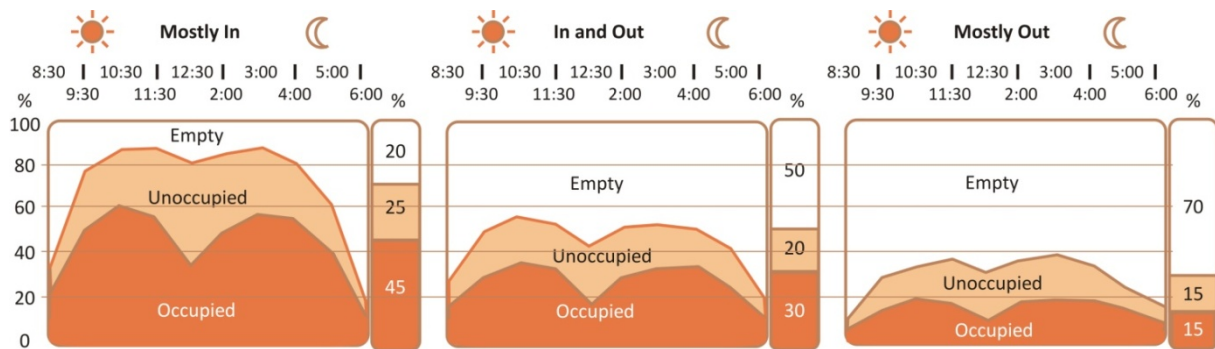


Figure 2.13. Desk usage across the working day (Marmot and Eley 2000).

Whilst the financial advantages of hot-desking could be easily understood, deciding how many desks will be shared amongst how many people and establishing the rules of sharing and how to deal with personal items storage is not as easy (Marmot and Eley 2000). An important issue with hot-desking is that it takes away the sense of belonging and the emotional ownership of space which are two very secure symbols for people. Hot-desking is often poorly implemented and as a consequence becomes an unpopular working arrangement amongst workers (Dowdy 2000; Lake 2005).

2.9.3 Virtual office

The concept of the virtual office refers to the idea that wherever one works is the workplace. Therefore the virtual office goes a step beyond teleworking as it allows office work to be done not only in telework centres or home office, but in an airplane, car, boat, airline lounge, restaurant or hotel lobby. For this to happen, technology is fundamental (Becker and Steele 1994). It is worth noting that this concept of virtual office is not to be confused with work collaboration hosted in virtual worlds as discussed in section 2.11.4 *Virtual worlds*.

As with teleworking and hot-desking this AWW can provide benefits to its adopters, but poor implementation can produce drastic results. Amongst the most talked-about virtual office implementation (for the wrong reasons) is that of Chiat/Day.

Self-defined as a frustrated architect, Jay Chiat, head and founder of Chiat/Day, a multimillion dollar advertising agency, believed that the environment impacts the quality of work and the type of people it attracts (Seo 1999). He also believed that chaos breeds creativity, which might have been his motivation to put in place the most controversial virtual office project (MacDonald 1999).

Chiat roughly identified two categories of office design: a) traditional office design, or 'storage architecture', where "employees park themselves at little archives of personal trinkets and business files that soon grow obsolete" and b) virtual offices or 'resource architecture', which eliminates the privatisation of individual workplace and offers employees the option to choose their own schedule and place of work (home or office). Chiat used to say that in a virtual office "you will have private space, it just won't be personal space" (Supervert 1995; Berger 1999).

Chiat's vision was clear: "Take away employees' cubicles and desks equip them all with portable phones and Powerbooks, and turn them into wandering nomads who could perform their tasks wherever they like. No time clock to punch" (Tsuchiya and Vithayathawornwong 2005). Chiat/Day's version of virtual office consisted of two things: an architectural superstructure and a technological infrastructure. Technology does not 'virtualise' the space,

as there is still the need of a physical environment. These architectural superstructures were located in Los Angeles, designed by Frank Gehry and in New York, designed by Gaetano Pesce. However, technology was the backbone of the physical offices that allowed people to become mobile. *"We have an office. But there's no office in the office"* said at the time an employee of the advertising agency (Supervert 1995).

On the first workday of 1994, the staff moved into their new virtual offices. The procedure was as follows. All employees should leave all personal items in small lockers. As Chiat said, that would be the place for people to *"put their dog pictures, or whatever."* Then employees headed to the *'concierge'* and *'store'* windows, to sign out a Powerbook (laptop) and a programmable portable phone, which needed to be returned at the end of the day. Once they were all geared up, they headed to the wide-open plains of the office where no designated place was allocated and the following policies applied (Berger 1999):

- *'Nesting'* was strictly forbidden. That is, no one could stay in the same place for more than one day. Chiat's daily strolls enforced such rule;
- Nothing could be left on the project rooms, tables, or anywhere in the office; and
- All information needed to be stored in the computer system. Sightings of paper were followed by emails reminding employees that the new office should be a paperless office. All documents were scanned and put into the system.

Following are the results of such policies (Berger 1999):

- Since employees were not allowed to leave any stuff anywhere in the office, they started using their car's trunk as file cabinets or hiding important papers, contracts, storyboard, etc. and then forgetting where they had left them;
- Due to the lack of personal space employees complained about being unable to concentrate, being totally exposed, and having no destination point in the wide-open plains of the office. As a consequence, the project rooms were overbooked and some employees started claiming meeting rooms as *"my office until somebody fires me"*;
- There were more people than equipment, due to a scaled-back equipment package lease. Therefore, employees stopped returning their equipment and started taking radical measures to secure their working tools. Tactics included arriving as early as 6 am to get their computers and phone, hiding them, then sleeping for a couple of hours before the *'virtual workday'* began;
- Part of the original idea was to foster people checking out of the office to work at remote locations. Such option was widely adopted to avoid the scrutiny of Chiat's virtual office rules. As one employee said, *"in a virtual office you can't hide."* However, they realised that people did not do much work when they were gone and soon the term *'going virtual'* became a synonym of gone for the day; and
- The lack of assigned space made it very difficult to find people even though they were in the building. There were cases of staff unable to find their creative department for two days. Once again, employees started developing conducts to overcome problems. A director tired of looking for people on the 30,000-foot New York office developed the *"three-time around"* rule: *"If I walked around the entire office three times and still couldn't find the person I was looking for, that was it. At that point, I was going home, and if someone needed me they could find me on my virtual couch."*

According to a former agency creative director Chiat's virtual office was *"the laughingstock of the industry"*. Although the virtual offices experienced problems in their operation just six months after opening, the project was not officially dead until 1998 when the firm abandoned both buildings, NY and LA, and moved to the new non-virtual offices in Playa del

Rey, where everyone has a desk and a hardwired phone (Berger 1999). In this 11,150 m² office, designed by Clive Wilkinson, its 540 people are often at their own desk and generate a great deal of paper (Marmot and Eley 2000).

Tsuchiya and Vithayathawornwong (2005), identify the following lessons to be learned from the Chiat/Day virtual office failure:

- The human needs for privacy and personal space should be of great concern;
- The process of developing and implementing the new system must involve employees directly and meaningfully;
- A thorough understanding of both positive and negative consequences of the changing system is imperative; and
- Technological equipment and systems are among the most critical success factors.

2.10 THE FUTURE OF THE OFFICE

“Will there actually be office buildings in the future?”

Marmot and Eley (2000).

As previously mentioned in section 2.7.1 *History*, technology acted as a glue forcing people to be in a specific place in order to share equipment and interact with their workmates. Today's technology is acting as a solvent which eliminates such need and allows people to use mobile technology and interact from different places (Marmot and Eley 2000).

Whilst offices have flowered as a building form and a social structure for a short, yet intense period, they could be a short-lived phenomenon, a transitional stage in economic revolution. Each technology revolution has been identified by a predominant type of building. During the agricultural period barns, byres, warehouses and transport depots were amongst the predominant buildings. Throughout the manufacturing period, or industrial revolution, factories and power stations flourished. For the new industrial state it was the office building. However, in today's society, the information society, it is not clear what type of building will be required (Marmot and Eley 2000).

“The business of the future may be run by executives who are scarcely ever in each other's physical presence. It will not even have an address or a central office- only the equivalent of a telephone number. For its files and records will be space rented in the memory units of computers that could be located anywhere on Earth... vast memory banks beneath the Arizona desert.”

Arthur C. Clarke, Profiles of the future in Marmot and Eley (2000).

2.10.1 Diffusion of innovation

Despite the logarithmic rate of technology development discussed in section 2.5.2 *Singularity point*, technology adoption seems to follow a linear rate, sometimes even stalling. In Australia, *“between June 2002 and June 2003, growth in use of IT generally was flatter. For instance, no growth occurred in the proportion of businesses using a computer, having access to the Internet or with a web presence”* (ABS-1377.0 2003).

The future of the office depends to a large extent on how well AWW are adopted by companies. Putting aside the challenges of implementing these alternatives, the inertia of traditional methods and the inherited human resistance to change can further delay the process. In 1872 Walter Bagehot, a British businessman and journalist on economics literature and government, wrote: *“one of the greatest pains to human nature is the pain of a new idea. It... makes you think that after all, your favourite notions may be wrong, your firmest beliefs ill-founded... Naturally, therefore, common men hate a new idea, and are disposed more or less to ill-treat the original man who brings it”* (Bagehot 1999). It is interesting that this quote is still applicable after 137 (as at 2009) years.

In 1903 Gabriel Tarde a French sociologist, plotted the first S-shape diffusion curve showing the level of adoption versus time for most innovation (Rogers 1995). Figure 2.14 shows Rogers' implementation of the S-shape.

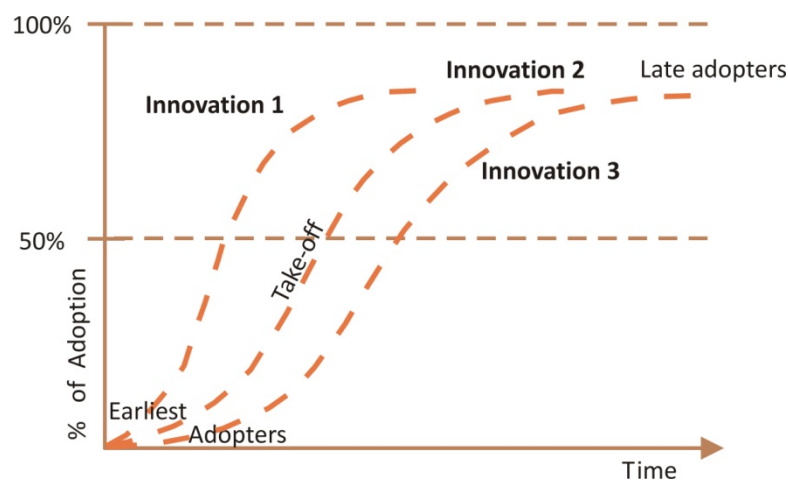


Figure 2.14. Diffusion innovation curves (Rogers 1995).

Then, in 1943, Bruce Ryan and Neal Gross studied the diffusion of hybrid seed corn innovation amongst farmers in Iowa and noted that the exchange of farmers' personal experiences with hybrid seed was the trigger of the diffusion. Their investigations included four main elements of diffusion: 1) a specific innovation, 2) processes of interpersonal and mass communication that created awareness of the item, 3) a specific kind of social system and 4) different individual types that make decisions at various stages of diffusion (Lowery and DeFleur 1995).

In 1962, Everett Rogers contributed to their findings by studying the diffusion phenomenon on innovations across disciplines. By diffusion is meant the *“process by which an innovation is communicated through certain channels over a period of time among the members of a social system”* and innovation refers to *“an idea, practice, or object that is perceived to be new by an individual or other unit of adoption”* (Rogers 1995). Rogers' diffusion of innovation contains four elements:

1. **Innovation:** Any item, thought, or process that is perceived as new by an individual or other unit of adoption. This can be:
 - a. Continuous innovation: Simple change or improvement of an existing item that the user already uses;

- b. Dynamically continuous innovation: Can be either a new product or a fundamental change to an existing one; and
 - c. Discontinuous Innovation: A totally new product which introduces new patterns.
 2. **Diffusion through the social system**: The means by which messages get from one individual to another. The nature of networks in which information flows and the roles opinion leaders play in them determine the likelihood that the innovation will be adopted. Intermediaries, known as '*change agents*' or '*gatekeepers*', between opinion leaders and the audience play an important role and are part of the process of diffusion.
 3. **Social System**: The group or groups of people that an innovation diffuses through. It can be divided in traditional and modern. Because of their characteristic (described below) modern systems accept and adapt better to innovation than traditional ones.
 - a. Traditional: A social system that has a low developed technology and levels of education, little communication with outsiders, lack of economic rationality and are one-dimensional in adapting and viewing others.
 - b. Modern: As opposed to the traditional system, this social system has a developed technology, values education, accepts free thought and new ideas, has strong preparation and high importance on economic considerations. It also has the ability to see and understand other people's situations.
 4. **Time**: How long it takes for the group to adopt an innovation and the rate of adoption for an individual.

The adoption process, understood as *"the mental process through which an individual passes from first hearing about an innovation to final adoption"* starts with the awareness stage in which *"the individual is exposed to the invention but lacks complete information about it"* then, in the interest stage *"the individual becomes interested in the new idea and seeks additional information about it."* Next, at the evaluation stage the *"individual mentally applies the innovation to his present and anticipated future situation, and then decides whether or not to try it"*. It follows the trial stage where *"the individual makes full use of the innovation"*. Finally, at the adoption stage *"the individual decides to continue the full use of the innovation"*. However, throughout the awareness to the trial stage the individual has the option to reject the innovation. Once adopted, the innovation can be discontinued by disenchantment as a result of dissatisfaction with its performance or by replacement in order to adopt a better innovation. This process is shown in Figure 2.15.

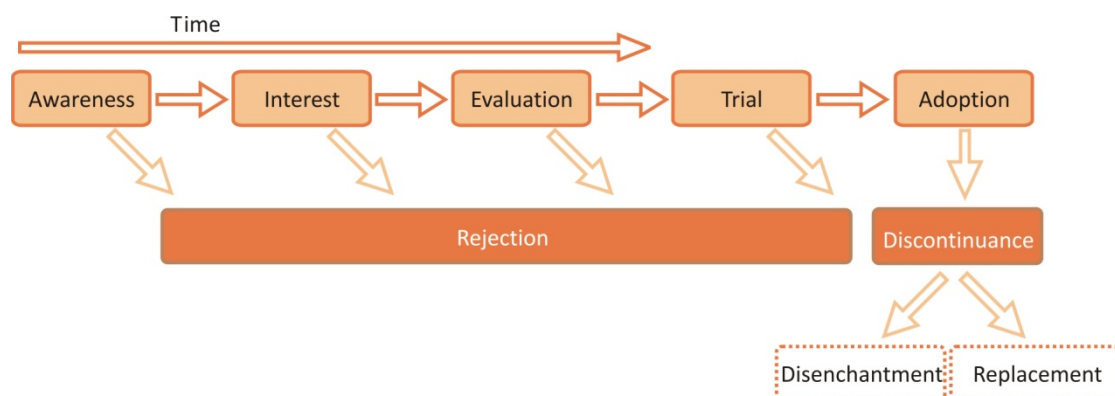


Figure 2.15. The adoption process (Rogers 1995).

Rogers (1995) makes the distinction that whilst the diffusion process deals with the group, the individual (or the decision maker unit) is the unit for the adoption process. He identifies five types of adopters depending on their readiness and capability to adopt an innovation as defined below.

1. **Innovators:** The risk takers. They have the ability to understand and apply complex technical knowledge and to cope with high degree of uncertainty about the innovation. Most importantly, however, they control substantial financial resources to absorb possible loss from an unprofitable innovation.
2. **Early adopters:** They are successful and respected by peers. Their high degree of opinion leadership affects most systems and they serve as role model for other members or society. They play a key role in the adoption process determining the time and extent in which an innovation will be adopted.
3. **Early majority:** Whilst they do not take as much risk as their predecessors, they do accept an innovation before the average person. They interact frequently with peers, yet seldom do they hold position of opinion leadership. They deliberate before adopting a new idea.
4. **Late Majority:** Their education and income are limited. Being sceptical and cautious, they will usually adopt the innovation under economic or peer pressure.
5. **Laggards:** They possess no opinion leadership, are isolated or surrounded by other laggards. Their resources are limited. Their point of reference is the past, therefore are suspicious of innovations and frequently by the time they adopt an innovation there is a new one already starting to take its place.

Rogers (1995) argues that adopter types follow a bell-shaped distribution as shown in Figure 2.16.

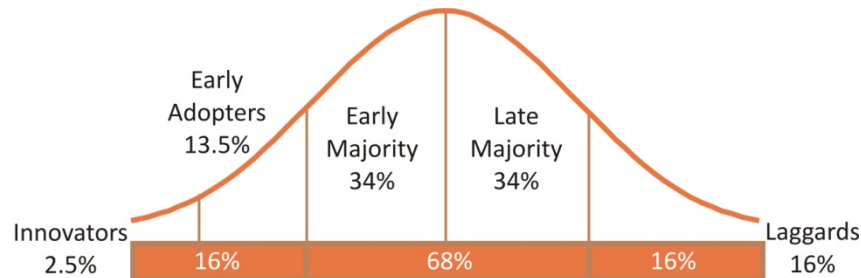


Figure 2.16. Distribution of adopters (Rogers 1995).

2.11 DEVELOPING TECHNOLOGIES

Following is a review of developing technologies that are considered by this study to have an impact in workplace architecture. However, predicting the way and extent to which these technologies will impact workplace architecture is challenging. After all, any prediction of such nature would be limited by our current understanding of the technology, expected rate of adoption and individual interest. The following quotes illustrate this:

"Computers in the future may have only 1,000 vacuum tubes and perhaps only weigh 1 1/2 tons."

Popular Mechanics, 1949 (Robbins and Alvy 1995).

"The Americans have need of the telephone, but we do not. We have plenty of messenger boys."

Sir William Preece, chief engineer of the British Post Office, 1878 (Wallop 2008).

2.11.1 Wireless electricity

Powermat Ltd is an Israeli company established in 2006 that has developed a commercially available system that uses magnetic induction and their proprietary Surface Connect Technology™ to transmit electrical power via an ultra thin mat embedded in, or overlaid on, surfaces to electronic devices placed randomly on the mat (Powermat 2008).

Powermat technology uses inductive coupling to transfer energy from one circuit component inside the transmitting Powermat to another one at the receiving end (electronic device) via a magnetic field, which is the key to transferring the power. The ultra thin transmitter (mat) transmits a magnetic field generated in an embedded coil matrix to a small receiver in the electronic device (Powermat 2008).

Using detection software, each and every coil can be activated independently to send power to a specific device. When idle, the mat scans the coils to find new receivers. When a receiver is located on the mat, a transferral of information between the two is initiated and calculates the required amount of power to be supplied. The processing unit continuously monitors for the presence of such receiver, and stops the power transfer when the receiver is removed, or it is fully charged. Multiple receivers can be powered at the same time. The surfaces are safe to touch and can work even underwater (Powermat 2008).

As claimed by the developers of the technology this technology has the potential *"to enhance the mobility and work efficiency of personal and shared spaces by facilitating comfort and wireless access to power practically anywhere throughout the office"*. Furthermore, the developers of this technology claim that this system could be implemented in an urban environment, creating spots for users to obtain power for their electric devices (Powermat 2008).

However, this technology stills requires a direct contact between the appliance and the special surface, and in some cases a cable from the unit to the surface, which limits this technology.

On the other hand, in the first half of 2007 a research team from MIT was able to light a 60W light bulb from a power source more than 2 metres away, without any physical connection between the source and the appliance. The team named it 'WiTricity', from wireless electricity (Hadley 2007).

WiTricity is based on coupled resonant objects. To explain how it works Hadley (2007) refers to the following example: *"imagine a room with 100 identical wine glasses, each filled with wine up to a different level, so they all have different resonant frequencies. If an opera singer sings a sufficiently loud single note inside the room, a glass of the corresponding frequency might accumulate sufficient energy to even explode, while not influencing the other glasses... If one ensures to operate in that regime in a given system, the energy transfer can be very efficient."*

The MIT team was puzzled as to why if WiTricity is based on well-known laws of physics, no one thought of it before. They believe that a plausible explanation is that in the past, there was no great demand for such a system, so people did not have a strong motivation to look

into it, but the proliferation of electronic devices has created an interest and demand to develop such technology (Hadley 2007).

This technology has the potential to create the so long expected nomad worker. As mentioned by Hadley (2007) *"imagine a future in which wireless power transfer is feasible: cell phones, laptop computers and other portable electronics capable of charging themselves without ever being plugged in, freeing us from that final, ubiquitous power wire."*

2.11.2 Hologram conferencing

In May 2008, Telstra beamed a mobile three dimensional image of its chief technology officer from Melbourne to Adelaide to give a live business presentation (AAP 2008). Refer to Figure 2.17.



Figure 2.17. Hologram teleconferencing (AAP 2008)

Whilst beaming holograms is not commercially available yet, Telstra CTO (Chief Technology Officer) believes that it could start to become commonplace in businesses within four or five years and eventually in homes. Telstra's group managing director for enterprise and government believes that *"this next generation network is changing the way we live and work"* (AAP 2008).

2.11.3 Concurrent Engineering

As defined during the first Institute of Defence Analysis (IDA) Workshop, Concurrent Engineering (CE) is *"a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements"* (Pennel and Winner 1989).

The left diagram (A) in Figure 2.18 shows the traditional serial design, also known as the sequential or 'waterfall' approach. This process is generally characterised by cycles of issue resolution, usually during meetings, which can take days, weeks or months. By comparison, in CE, right diagram (B), all participants can work together in real time, with physical or virtual collocation. Issues are identified and resolved quickly because all information is at hand and all personnel are present. Thus, meeting cycles are eliminated. The entire team can quickly change direction to instantly react to new information (Oberto 2005).

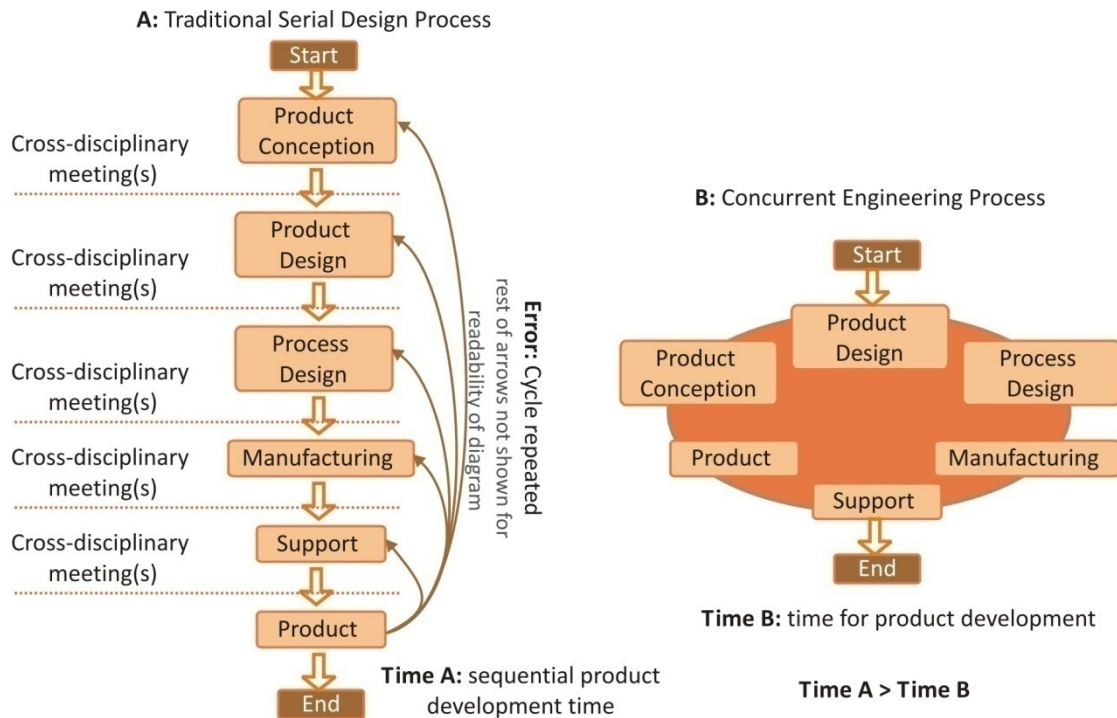


Figure 2.18. Traditional vs. CE approach (Dwivedi *et al.* 1990; Oberto 2005).

Smith (1997) states that there are four fundamentals of CE:

1. The increased role of manufacturing process design in product design decisions;
2. The formation of cross-functional teams to accomplish the development process;
3. A focus on the customer during the development process; and
4. The use of lead time as a source of competitive advantage.

A key for CE, and the relevant topic for this research, is point 2. This is because the method to accomplish the integration of design with other functions (and removing functional barriers) requires the use of cross-functional teams. These teams may include people with expertise in production, marketing, finance, service, or other relevant areas, depending on the type of project (Smith 1997). As further explained, these teams work in very specific environments.

Since the middle 1990s, a Jet Propulsion Laboratory (JPL) design group called '*Team X*', in the US, has implemented CE for conceptual stage designs of space mission. Team X claims that CE saves cost and time for concept generation and trade studies. They have been able to reduce concept design time from 6-12 months to 1-2 weeks and study costs from USD\$1,000,000 to USD\$60,000 (CIFE 2008).

Figure 2.19 shows the architectural CE layout adopted by Team X. There are three rooms hosting three areas of design: Instrument, Architecture and Mission Study teams. These rooms are specifically designed not only to allow, but promote, collaboration between engineers from diverse disciplines like propulsion, mechanical, thermal and so on (CIFE 2008). Team X and Stanford University argue that a multi-screen interactive environment is necessary to allow disparate design teams to describe and explain their own models and to interpret those of their colleagues, both effectively and quickly (Kunz and Fischer 2008). Hence, the various screens and smart boards



Figure 2.19. Team X CE rooms layout (CIFE 2008).

Figure 2.20 shows a picture of the above Mission Study Team room (lower left room). The picture shows diverse specialists working simultaneously, in the same place, with shared data, to yield an integrated design (CIFE 2008).



Figure 2.20. Team X CE room (CIFE 2008).

The above environment, originally developed by CIFE at Stanford, has two parts: technology and methodology. As described by Kunz and Fischer (2008): *“The environment includes multiple touch-sensitive displays, each showing the projected screen of a computer. The method attempts to remove most non-value adding diversions from the attention of the design staff as they participate in a CE session, such as clarifications of goals, methods or vocabulary, secondary responsibilities and waiting for responses to questions from fellow stakeholders. In the absence of diversions for designers and with technology, methods and skills to do very fast design and analysis, the design team achieves response latency of about*

a minute in greater than 99% inquiries by all members of the design team, which in comparison with routine practice is both very fast and very reliable."

Figure 2.21 shows a room used by NASA during mid 1960's to perform similar tasks (rocket design) equivalent to Team X's CE room.



Figure 2.21. NASA design studio mid 1960's (NASA 2009)

The differences between these two rooms are various. Two of the most apparent are the concentration of people, which is higher in the CE room (computers occupy less space than drawing boards) and the fact that the CE room cannot benefit from natural light as the 1960's studio did due to monitor glare. Most importantly (for this study), however, is that people in the 1960's studio needed to physically displace to see the design of others or to collaborate, which in itself would have hindered a CE approach.

CE is not limited to manufacturing or space exploration projects. Virtual Design and Construction (VDC) uses CE principles to integrated multi-disciplinary performance models of design-construction projects in the AEC (Architecture Engineering and Construction) Industry to support explicit and public business objectives (Kunz and Fischer 2008).

VDC models are virtual models that show computer-based descriptions of the project. These models are logically *integrated* in the sense that they all can access shared data, and if a user highlights or changes an aspect of one, the integrated models can highlight or change the dependent aspects of related models. The models are *multi-disciplinary* in the sense that they represent all the AEC project stakeholders (Kunz and Fischer 2008).

Given the intensive multidisciplinary collaboration required to develop VDC models, Kunz and Fischer (2008) recommend the use of iRooms. iRooms are collaborations rooms similar to the ones used by Team X. The investment of an iRoom is estimated in USD\$70K, including hardware, software and training. Investment that, they argue, can dramatically increase revenue under the right market (Kunz and Fischer 2008).

These types of rooms, with different names, are starting to be adopted by various AEC companies. Figure 2.22 shows what Skanska, one of the world's leading construction groups, refers to as 'Virtual Big Room'. The room has a High Definition (HD) video and smart boards linked remotely via Webex or LiveMeeting (online meeting services). Similar rooms are

installed at Skanska's office, the Architect's office and site trailer. As mentioned by a Skanska director: *'Adoption has been slow but positive. Bandwidth is key to feasible remote interaction with digital media'* (CIFE 2008).



Figure 2.22. Skanska's 'virtual big room' (CIFE 2008).

Another example of how VDC is changing work collaboration is the engineers and quantity surveyors at NCC, a leading Swedish construction company. Before VDC, engineers and quantity surveyors of this company used to sit in separate groups at different parts of the room. However, because of VDC and the implementation of CE methodologies and tools, both groups of professionals are now mixed in order to arrive at concurrent solutions (CIFE 2008).

It is thus considered that CE is a methodology that not only has specific spatial requirements, but heavily depends on technology and affects the way people interact with each other. The benefits reported by the adoption of this methodology suggest that it will be adopted by more companies across more disciplines.

2.11.4 Virtual worlds

Bartle (2004) argues that there is vast potential for virtual worlds in a variety of areas including geography, sociology, anthropology, psychology, gender studies, economics, theology, and the most important for this research: architecture.

Virtual worlds offer architects various advantages over the physical world. As noted by Cicognani (2003) planning of physical spaces needs to go through a more complex and longer series of approval procedures than virtual spaces before having any chance of being implemented. Also, the development and changes to physical space are slower, more costly and considerably more difficult to achieve. For example, reorganising virtual worlds is possible; on the other hand moving a physical building is rarely possible at all. Table 2.12 shows the flexibility of virtual spaces, unmatched by its counterpart.

Table 2.12. Comparison between physical and virtual space design (Cicognani 2003).

| | Physical space | Online (virtual) space |
|--|--|--|
| Portability of entities | Rarely possible (for buildings) | Possible |
| Modification of entities | Slow, expensive | Fast, cheap |
| Reversibility to original state | Rarely possible, very slow | Possible, fast |
| Distribution of elements (geographical organisation) | Continuous | Discrete |
| Parties involved in the design and building process | Multiple, often in conflict, often difficult to access | Reduced, easily accessible |
| Length of negotiation process | Long | Short |
| Design responsibility | Shared with local governments | Shared between system managers (co-ordinators) and users |

Cicognani (2003) argues that virtual worlds require real architects and believes that the absence of spatial organisation of virtual worlds is a common obstacle to the establishment and growth of these environments. Most commonly, she believes, these environments are designed using a vernacular approach to organising and distributing space, in relation to the activities required by the environment. As a consequence, many of these communities dissolve after short periods or require considerable '*refurbishments*'. However, the cost involved in the process together with the risk of discouragement, if not alienation, of users are considerable.

Cicognani believes that architects understand space and how to manipulate it presumably better than any other profession, and as such they should be given the responsibility to design online spaces in order to make them more comfortable and useable. Amongst her reasons are that architects are:

- Familiar with space organisation;
- Aware of the relationship between space organisation and performance;
- Have a good understanding of the design process, and its negotiating and executive phases; and
- Know how to transform basic materials into functional elements (e.g. brick/wall).

However, since architecture traditionally deals with physical things, it must be rethought as an instrument to understand the non-physical (virtual) world. Following is a list of elements that Cicognani (2003) believes architects should consider whilst designing virtual environments.

- **Matter:** The matter of the physical world is the physical material (e.g. timber, concrete) and the laws governing those elements need to be taken into consideration for the design not to collapse. As further explained in section 2.11.4d World physics, virtual elements do not follow the physical world physics, but still need to follow their own. Both materials (real and virtual) also need to be used following a specific technique (construction method for real world, programming language commands for virtual ones).
- **Coherence:** This is related to world physics and states that the metaphorical coherence of an online environment is fundamental for its utility and flexibility. This means that when designing the parts, designers need to consider how suitable (coherent) they are in relation to the whole environment. As an example, in a real world classroom it is not expected to find a kitchen stove; having one would appear out of place (unless, of course it is a classroom where cooking is taught). If the use of

an element does not correspond to the metaphor it represents, it becomes inconsistent, difficult to use and organise. Coherence is thus very important to allow users to take the first steps towards understanding the principles applicable to these worlds. It is a social responsibility of designers to make sure that the built environment (even in its electronic form) responds to basic principles of useability and comfort.

- **Feedback speed:** An important aspect of design is the feedback speed of decisions. In online worlds, designers can watch the effects of their actions in a relatively short period of time, compared to design actions performed in the physical world. Moreover, designing a building and constructing it are two very separate processes, which also require very different skills. However, in virtual buildings the design and construction process often overlap.
- **Control:** Being able to check the results of a design without waiting for the construction phase, leads to more control of the design and the possibility to modify it until the desired results are achieved. Further, the control is maximised in virtual environments because the designer is usually the builder, as opposed to physical buildings. Also, in virtual worlds each item has an owner and only that owner, or system administrator, can modify or destroy it. Thus, through digital ownership it is easier to control virtual elements and isolate them from undesired actions which real buildings are prone to (e.g. graffiti).

Because of the above and, as previously mentioned in section 2.4 *Space (and cyberspace)*, virtual worlds are paramount to this research as they can ease and decongest physical world situations, or create new solutions to common architectural problems including office environments. Thus, a more comprehensive review of this technology is done below.

2.11.4a Background

A virtual world, also known as MUD (Multi-User Dungeons), refers to an environment (world) in which its inhabitants are self-contained. The adjective '*virtual*' combines the concept of real (that which is) with imaginary (that which is not) to become that which is not, having the form or effect of that which is (Bartle 2004).

Virtual worlds are implemented by a computer (most likely a network of computers) that simulates a specific environment. Virtual worlds may have different purposes, but they share similar characteristics which differentiate them from other computer based interactions like chat rooms or social networks like Facebook (Bartle 2004). Based on Bartle (2004) the characteristics of virtual worlds are:

- **Shared:** several people can affect the same environment simultaneously;
- **Persistent:** even when there are no people interacting, the environment continues to exist and develop;
- **World physics:** are the underlying, automated rules that enable players to effect changes to it, but not the rules that grant them this ability. This is further described in section 2.11.4d. *World physics*;
- **Virtual self-representation:** real people have a representation of themselves in the in world. Since virtual worlds developed in the gaming industry, characters are usually referred to as players or avatars, rather than users; and
- **Real-time:** feedback of the interaction that happens in the in-world between the character and the surroundings (including other characters) is expected almost immediately.

2.11.4b History and development

Virtual worlds originated as computer games, and despite having many applications, they are still more popular and generate considerably more revenue in the computer game industry than in any other application. Whilst first virtual worlds relied on text only to describe the environment and events occurring in them, the introduction of graphics overtook text-based MUDs (Bartle 2004).

As noted by Bartle (2004) the conception and evolution of virtual worlds is marked not only by various developers and technologies, but by changes in their commercialisation strategies, technology and their acceptance by the players. Following is a summary of the five ages of virtual worlds as described by Bartle (2004).

The first age cover the period from 1978 to 1985 and includes the development of the first virtual world developed at Essex University, England, in 1978 by Roy Trubshaw. Roy was a Computer Science undergraduate and his motivation was to create a multiplayer adventure game that combined his interest in writing computer programmes. The introduction of modems and JANet (Joint Academic Network) allowed virtual worlds to extend beyond Essex University. At this stage the software was limited to 36 simultaneous players. Other students started to write their own virtual worlds from scratch, but they all eventually ran into the same maintainability problems. In late 1979 Avatar, the first ever fully functional graphical virtual world was released, but its technological requirements were not available to home users until 15 years later.

The second age covers the period from 1985 to 1989 and was marked by the development of various virtual worlds by various developers. Virtual worlds started to be commercialised in the US via CompuServe and in UK via CompuNet. Around this time a new computer language known as MUDDLE (Multi-User Dungeon Definition Language) was developed specifically to develop virtual worlds. By 1987 all the protocols and in-game tools to develop virtual worlds were well developed. Most of the text based virtual worlds written during this age were programmed by enthusiasts at home. A turning point that marked the end of this age was when virtual worlds started to be programmed in 'C' (a programming language) and were able to run under Unix (operating system).

The third age, from 1989 to 1995, is characterised by a 'viral' spread of virtual world development across various universities. However, their functionality was still very limited. Players could only create things and spent most of their time doing just that and talking about it. Still, a study of traffic on the NSFnet backbone in 1993 showed that 10% of all transferred data could be attributed to virtual world players.

During the fourth age, from 1995 to 1997 virtual worlds became more popular as they started running on PC's as a dial-up game. As a consequence, people in the UK were spending up to 1/3 of the average salary at the time on telephone bills. However, in the US, local telephone calls were basically free and CompuServe recruited over a million subscribers to its system, charging them premium rates to access data. Virtual worlds became a big part of CompuServe profits. The WWW (World Wide Web) changed all this and most of the games that had been on services like CompuServe set themselves up as independent games on the Internet.

Finally, by the fifth age, from 1997 to 2003 (end of Bartle's review), at least a hundred graphical virtual worlds were announced. However, by the end of 2000 there were only three big virtual world games: Ultima Online (launched 1997), Asheron's Call (launched

1999) and EverQuest (launched 1999). Each had hundreds of thousands of players, with the latter exceeding 10% of Norway's population.

2.11.4c Virtual worlds, not games

As mentioned above, virtual worlds began as games. However, right from the beginning, it was clear that there was more to them than being mere games. Nonetheless, a problem (ongoing) that virtual worlds have is trying to convince people to take seriously what they consider to be a game. For example, in the case of the academic world, virtual worlds were not taken seriously until they were considered as simulations (Bartle 2004).

From simulations, virtual worlds were rebranded to services when a senior designer made the point that virtual worlds are a medium through which many services (games included) can be delivered. Despite referring to them as services or simulations, virtual worlds were still perceived to be *'just a game'* (Bartle 2004).

However, Bartle (2004) argues that virtual worlds are not simulations, because they do not simulate anything. They only go as far as approximate aspects of reality with enough detail for the purpose of immersion. He also believes that whilst virtual worlds require a service (e.g. internet connection) to access them, they are not a service themselves: *"restaurants provide a service, but the food they serve isn't a service."* Above all definitions, Bartle is convinced that virtual worlds are not games. Even the virtual worlds created to be games, are not games. Virtual worlds set the venue as much as a sport stadium does, but the stadium is not a game.

Bartle (2004) defines virtual worlds as places: *"Virtual worlds are places. They may simulate abstractions of reality, they may be operated as a service; creating them may be an art; people may visit them to play games. Ultimately, though, they are just a set of locations. Places."* This definition anchors the importance of virtual worlds to the office of the future.

2.11.4d World physics

World physics are the set of rules that govern the behaviour of objects (people, furniture, trees, etc) inside the virtual environment. Although creating virtual worlds has the potential of liberating us from the rules of real world physics, people could get confused by an alternative physics (Bartle 2004). Introducing a world physics helps users to better understand the environment (Bartle 2004, Cicognani 2003).

As mentioned by Bartle: *"If I push a door [in the real world] the door opens. If I push on a virtual door, the virtual door opens. I could just as easily make it that if I push on a virtual door, virtual birds fly out of a virtual mug."* Breaking the standard convention of cause-and-effect rules interrupts the virtual world. On the other hand, anything that adheres to them implicitly supports the illusion that the virtual is real. Thus, virtual world physics aims to implement the obvious so that users do not have to suspend any disbelief and their senses pass the information right by without comments (Bartle 2004).

Virtual world designers are faced with numerous decisions whilst developing their world physics. As noted by Bartle (2004), at what rate will virtual ice melt?

Whilst greater computational resources can produce better world physics, they are no substitution for knowing just which physics are enough to create the required level of detail. The same needs to be considered with activities. Would opening a door require the player to take out a virtual key from her pocket, insert it in the door, turn the key and so on? or is just a command to *'unlock a door'* enough?

From the various physical dimensions, time is the only dimension that is shared between the character and user. However, this does not mean that it has to be identical to real time, but it does mean that it must directly map to it (Bartle 2004).

Parallel to world physics, the way avatars interact with each other is crucial to enhance the virtual world immersion. As further discussed in Chapter 9, being able to read emotions is important for work related collaboration. Brave and Nass (2003) argue that emotion is a fundamental component of being human and as such, efforts have been made to incorporate emotions into avatars Werner (2008). Facial expressions, note Brave and Nass, provide a fundamental means by which we detect emotion. Figure 2.23. shows an avatar displaying different facial cues to denote different emotions.



Figure 2.23.Avatar showing different emotions (Werner 2008).

Based on Ekman and Friesen's (1977) Facial Action Coding System, Brave and Nass (2003) argue that emotion through facial recognition can reach as high as 90-98% accuracy on a small set of basic emotions. However, they recognise that current recognition systems are tested almost exclusively by asking subjects to make specific facial movements or emotional expressions, rather than natural expressions resulting from actual emotions. The problem remains of distinguishing real emotions revealed by real body language and emotions concealed by synthetic body language.

Cacioppo *et al.* (1997) argue that not all emotions are accompanied by visual perceptible facial action. Through speech rate, pitch, intensity and articulation, voice can also reflect emotions like fear, anger, sadness, happiness and disgust (Murray and Arnott 1993).

2.11.4e Second Life







Second Life is a virtual world developed by Linden Lab, launched in June 2003 (Wikipedia 2009c). In 2006, Linden Lab claimed that Second Life was running on a couple of thousand servers and covered an area (in real terms) of 30 thousand acres, equivalent to Boston, Massachusetts, in the US.

Second Life, as defined in their website, is a "*free 3D online virtual world imagined and created by its Residents. From the moment you enter second life, you will discover a fast-growing world filled with people, entertainment, experiences and opportunity*". Second Life is an environment restricted to 18 years or older. There is an alternative for teenagers between 13 to 17 years old called Teen Second Life (Second Life 2009).

Manchester Digital Development Agency in conjunction with Second Places, a virtual world developer, created a replica of the real life Urbis Museum within Second Life. Urbis Second Life hosts various virtual exhibitions and other events related with the museum (second

places 2009). Table 2.13 compares the Second Life environment (left) with the first life, real environment (right).

Table 2.13. Urbis Museum: first life / Second Life comparison (second places 2009).

| | Second Life Environment created by Second Places | First life Real life environment |
|-----------------|--|---|
| Bird's eye view |  |  |
| Elevation |  |  |
| Internal view |  |  |

Following the discussion on section 2.11.4c *Virtual worlds, not games*, it is interesting that the second question (just preceded by “What is Second Life”) in Second Life FAQ (Frequently Asked Question) is: “Is Second Life a game?” More interesting is their short, and ambiguous, answer: “yes and no” (Second Life 2009).

Linden Lab argues that whilst their interface and display are similar to other popular Massively Multiplayer Online Role Playing Games (MMORPGs), they have two characteristics that set them apart from MMORPGs: creativity and ownerships. Linden Lab sustains that Second Life is creative because it provides “almost unlimited freedom to its residents” so that the world is defined by what users make of it. In terms of ownership, residents “retain intellectual property of rights over their in-world creations” (Second Life 2009).

To be able to use Second Life users/players need to download a free viewer available for Windows, Mac and a Beta version for Linux. The minimum system requirements to run Second Life are cable or DSL Internet connection. Second Life is not compatible with dial-up, satellite and some wireless internet services. Across the three platforms (PC, Mac and Linux) the minimum requirements are a screen resolution of 1024x768 pixels with specific NVIDIA or ATI graphics cards. Whilst the system will run with 512 MB, 1 GB or more is recommended (Second Life 2009).

Second Life has its own currency known as Linden Dollars (L\$). All residents can earn L\$ by making and selling goods and services, holding events, and playing games. Residents can then use their L\$ to buy virtual items equivalent to the ones available in real life including clothing, land, a house, etc. Buying L\$1 costs USD\$0.30 as at April 2009 (Second Life 2009). There is thus a real price to pay for engaging in Second Life's virtual activities.

In November 2006 there were 58 residents earning more than US\$5,000 a month from their trading activities on Second Life and about 13,800 profitable residents overall. The majority of profitable business owners made less than US\$10 per month, and about 90% made less than US\$200 a month (Reuters 2008).

Whilst joining Second Life is free, a premium membership (which includes L\$1,000 signup bonus, a weekly stipend of L\$300 and land ownership) can cost between USD\$6.00 to USD\$9.95 per month. Land purchase cost up to USD\$1,000 per region, plus a land maintenance fee of USD\$295.00 per month (Second Life 2009).

Linden Lab claims that Second Life enables organisations to build costume immersive spaces and applications that increase productivity, creativity, and innovation whilst cutting travel costs and doing business in a more eco-friendly way. Fortune 500 companies, like IBM and Northrop Grumman, are amongst their clients using Second Life as collaborative virtual workspace (Second Life 2009).

Second Life / IBM Case study

A recently released case study jointly done by Linden Lab and IBM documents the experience of the latter hosting a conference and their annual meeting in Second Life. As noted by people involved in these two events, they were quite successful and are regarded by Linden Lab as a *"real proof that working in-world works"* (Second Life 2009). It is important to note, however, that firstly, this case study is based on a conference and an annual meeting, and although it could be argued they have interactions similar to those experienced whilst working, they do not translate to working in-world experiences. Secondly, the case study shows no evidence of following academic case study protocols as the one suggested by Yin (refer to Chapter 6) or similar authors. As mentioned by one 'blogger' in Second Life: *"I think in time there will emerge the academic studies or industry studies on their own, after all, you can't expect [Linden Lab] to undertake the process of industry analysis of itself."* Thus, results and comments from this 'case study' should be taken with caution. Still, this document is valuable to the extent that it documents the experience of using virtual worlds for non-gaming large scale events.

In late 2008 IBM's Academy of Technology (AoT) held their first large scale Virtual World Conference. The 200 plus participant conference was hosted in a secure Second Life environment with various spaces specifically designed for the event including keynotes, breakout sessions and various areas for community gatherings (LL/IBM 2009).

Setting up the virtual environment had a cost of approximately USD\$80,000. However, IBM believe they saved over USD\$250,000 in travel and venue costs and more than USD\$150,000 in additional productivity gains, given that participants were already at their computers and could return to work immediately. As a consequence, IBM believe they saved up to USD\$320,000 by doing the conference virtually. The President of AoT mentioned that: *"the meeting in Second Life was everything that you could do at a traditional conference, and more, at one fifth the cost and without a single case of jet lag"* (LL/IBM 2009).

Parallel to the cost benefits, IBM were also satisfied with the way people used the virtual environment to socialise and network: *“at the end of each day, participants were found gathering in various places for conversation over virtual cocktails”* (LL/IBM 2009).

The success of IBM’s virtual conference motivated the President of IBM’s AoT to host their upcoming Annual General Meeting, scheduled for the following month, in Second Life. With 2 week notice the real-life event in Florida, US, was cancelled and the organisation of the Second Life conference started. This event was larger in scale than the previous conference and had a varied agenda running over 3-days which required different types of spaces. Whilst some of the previously developed environments designed for the virtual conference were able to be re-used, the complexity of the event prevented the exclusive use of Second Life and some portions of the event utilised webcasting and video conferencing (LL/IBM 2009).

Social time, such as (virtual) cocktail hours, was scheduled and at the end of the conference the organisers scheduled a two-hour networking event on the beach. AoT’s members gathered around drinking virtual beers and chatting whilst others took virtual hang gliding or jet skiing lessons (LL/IBM 2009). Figure 2.24 shows a screen shot of one of the breakout areas of the Annual General Meeting. This ‘picture’ shows participants of the event represented by unconventional avatars (a yellow submarine, a fairy, a teddy bear, etc.) gathering around a fire at a grass beach.



Figure 2.24. Breakout area at IBM’s AoT annual general meeting (LL/IBM 2009).

At the completion of the event, the AoT President commented: *“The immersion [in Second Life] resulted in a very strange, yet compelling psychological effect, where part of me really felt like I was physically there. And I would watch myself walk around and talk to people”* (LL/IBM 2009).

IBM marketing executive mentioned that: *“when people woke up the morning after the virtual meetings and thought about the day before, it wasn’t like remembering a webcast or a phone conference. We truly felt we had attended a real-life meeting interacting with others and carrying home practical information”* (LL/IBM 2009).

2.11.4f Working environments in Second Life

Rivers Run Red Inc. is the US based company behind IMMERSIVE WORKSPACES™, a work collaboration platform developed in Second Life. Their system allows clients to use a virtual environment to virtually meet with other people, broadcast their desktop, connect with colleagues and have a journal of the activities done in the virtual world (RiversRunRed 2009).

The company claims the their work space solution creates a virtual space devoted to collaboration that closes space and time gaps for research and development, design, and engineering teams; cuts across company silos, allowing employees to connect; reduces cost and time spent away from primary job functions due to unnecessary travel; reduces carbon footprints; attracts talent to organisations and improves retention; increases productivity by decreasing the time, lag, and isolation of linear communication; improves work life balance by creates a less stressful environment, allowing people to address and create a balance between work, travel and family/leisure time (RiversRunRed 2009).

Figure 2.25 shows on the left an external view of Immersive Workspaces facilities. On the right a collaboration meeting using whiteboards is shown.



Figure 2.25. Immersive workspaces environments (Rivers Run Red 2009).

2.12 SUMMARY

The relationship between People, Space and Technology as briefly introduced in Chapter 1 was further detailed in this chapter and the various models proposed by several authors reviewed. An individual analysis of these three concepts within the focus of the research was done. Generational change was the focus for People, the nature of space and an introduction to cyberspace (virtual worlds) was the focus for Space, finally the concept of technology, the technology of technology and singularity point were the focus of Technology.

The office as a concept and its history were examined. The role that technology, in particular the typewriter, the computer and Internet had in shaping today's office was reviewed.

Three office models (pre-industrial, industrial and information age) were discussed together with a review of office types (layouts). The latter included a detailed discussion on open-plan offices.

The concept of the office of the future and its expectations were reviewed. Two of its myths: a jobless society and paperless environment were also discussed.

A review of Alternative Ways of Working was presented with focus on teleworking (including a review of SUSTEL Project), hot-desking and virtual office. Chiat/Day attempt of virtual office was included to illustrate the risks of introducing technology without taking into consideration people's needs.

It is considered that the future of the office depends to a large extent on how AWW are adopted by companies and as such Rogers' diffusion of innovation theory was discussed.

Finally, a review of wireless electricity, hologram conferencing, concurrent engineering and virtual world was done. These technologies are considered by this study to have the potential of considerably impacting workplace architecture.

The above literature review not only provides the theoretical framework of the research, but it is used, and complemented, in Chapter 11 to discuss the results.

RESEARCH DESIGN

CHAPTER

3

3.1 INTRODUCTION

Based on the context described in Chapter 2, this chapter defines the research questions as well as describes and justifies the proposed research design and methodology to address them.

This chapter is divided in two sections. The first section, Research design, defines the research questions and classifies them into variance and process questions. The second section, Research approach, defines the epistemology, ontology, theoretical perspective, methodology and methods adopted by the research. This last section, together with relevant sections of Chapter 5 were edited and published in the conference paper *“Research model for evaluating the impact of technology in workplace design in Australia”* as referenced in section 1.7.2 Conferences as presenter.

The research instrument is developed in Chapter 4 and tested in Chapter 5.

3.2 RESEARCH DESIGN

The objective of the research design here developed is to collect and analyse data in order to properly address the research questions and produce results in a useful and meaningful fashion to architects, facility managers and business managers.

3.2.1 Research questions

Grand-tour questions are the broadest questions that can be asked so as not to limit the inquiry (Creswell 1994). The two grand-tour questions of the research are:

- a) **To what extent is information technology changing workplace architecture?**
- b) **How is information technology changing workplace architecture?**

Based on Maxwell (1996) the above questions can be classified into variance and process questions. Question ‘a’ is a variance question because it focuses on differences and correlations and tries to establish whether or not there is a particular relationship between technology changes and workplace architecture. On the other hand, question ‘b’ is a process question because it focuses on how things happen. The focal point of process questions is not in explaining a difference in a dependent variable in terms of some independent variables, but in understanding how the phenomenon develops. This difference between variance and process questions requires that each grand-tour question, together with their sub-questions, follow different approaches.

The series of sub-questions that emerge from each grand-tour questions are listed in Table 3.1. However, as noted by several authors (Creswell 1994; Vaus 1995; Maxwell 1996) the initial research questions evolved as new issues emerge from continuously reviewing the literature and by limitations and/or opportunities that arose during the pilot study. This is further commented in Chapter 6.

Table 3.1. Research questions.

| Variance | To what extent is information technology changing workplace architecture? | | |
|----------|---|---|---|
| | ID ¹ | Sub-questions | Rationale |
| | SQ-V-1 | Will there be a change in the type of office space required in the future? | This question tests whether IT has any effect on the kind of space required to perform work activities. |
| | SQ-V-2 | Will there be a change in the amount of office space required in the future? | This question tests whether IT has any effect on the quantity of space required to perform work activities. |
| Process | How is IT changing workplace architecture? | | |
| | ID | Sub-questions | Rational |
| | SQ-P-1 | Why is IT changing space requirements in the office environment? | The focus on this question is not to explain a difference in terms of some independent variables, but to understand the process of how IT is changing workplace architecture. |
| | SQ-P-2 | How will the office of the future be like? | The answer to this question defines the space requirements needed to host the workplace of the future. |

3.2.1a Variance questions

As previously mentioned, variance questions focus on relationships, whether something causes or affects something else. In cause and effect terms there are three types of variables as follows and shown in Figure 3.1 (Vaus 1995):

1. **Dependent:** depends on something else (the cause) and it is symbolised by 'Y';
2. **Independent:** is the assumed cause and it is symbolised by 'X'; and
3. **Intervening:** is the means by which the independent variable affects the dependent variable and it is symbolised by 'Z'.

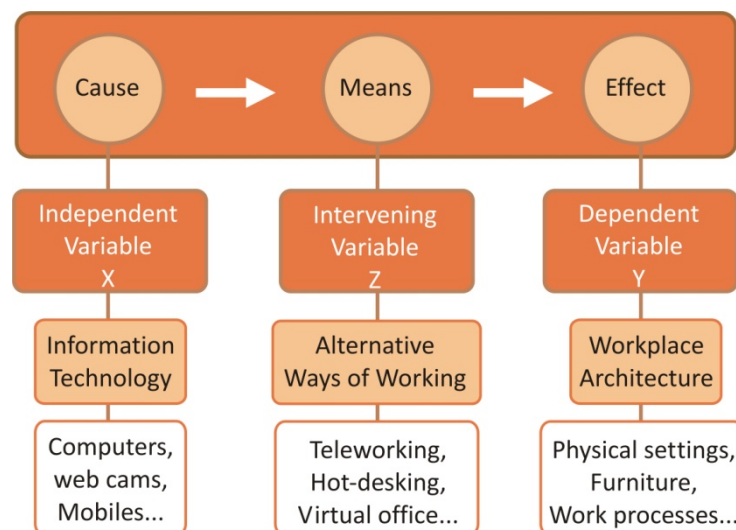


Figure 3.1. Variables for variance questions

¹ The prefix 'SQ' in the ID stands for 'Sub-question'; the preceding 'V' or 'P' denotes a 'Variance' or 'Process' question, respectively. The last digit is a consecutive number.

The above figure is at the core of the study as it tries to establish if IT, as the cause, affects workplace architecture, through the implementation of alternative ways of working or by the adoption of technologies like the ones described in Chapter 2.

Vaus (1995) stresses the importance of eliminating alternative explanations of the patterns. That is, when using a casual model like the one shown in Figure 3.1 which proposes that 'X' produces 'Y', it is essential to ensure that in fact is 'X' and not 'A', 'B' or 'C' that produces 'Y'. In this regard, Becker and Steele (1994) note that technology is one, but not the only, source of change in office design. Pressures within the organisation like corporate decisions to combine departments to improve communication and integration, can also change the design of the place where people work, refer to Figure 3.2. Chapter 2 also described the impact of generational trends (demographics) in the workplace. Studying each organisational influence on workplace design is out of the scope of this research. Thus, whilst this research acknowledges that other factors (e.g. global markets and outsourcing) affect workplace architecture (Y), this study and thus its research instrument is set to measure and focus on the impact of information technology only.

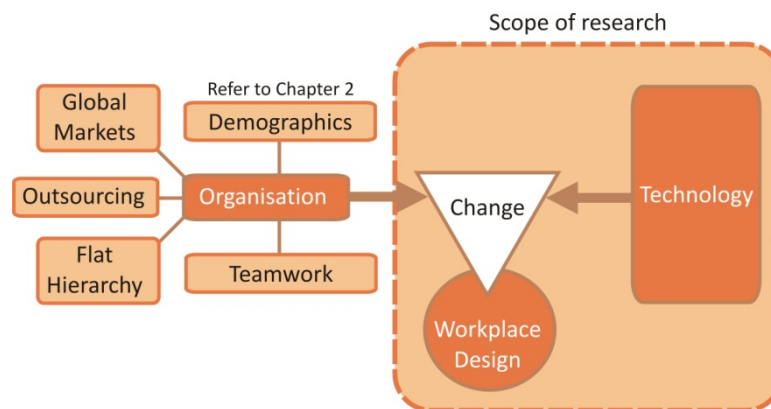


Figure 3.2. Changes in workplace design (Becker and Steel 1994).

3.3 RESEARCH APPROACH

"The assumptions we make about human knowledge and assumptions about realities encountered in our human world, will impact the meaning of research questions, the purposiveness of research methodologies, and the interpretability of research findings."

Crotty (1998).

The research literature offers numerous epistemological positions, quite a number of theoretical stances, many methodologies, and almost countless methods. The justification of the use of a particular methodology depends on the assumption about reality that the study adopts. Moreover, because each research is unique, it is by no means a matter of plucking a methodology *'off the shelf'* (Crotty 1998). In order to develop and establish a suitable research method for this study, a discussion about the research's epistemological position, theoretical perspective and methodology is required.

Table 3.2 shows some of the options that each of above four basic elements of the research process can adopt.

Table 3.2. Research design options (Crotty 1998).

| Epistemology | Theoretical perspective | Methodology | Methods |
|---|---|---|---|
| <ul style="list-style-type: none"> • Objectivism • Constructionism • Subjectivism (and their variants) | <ul style="list-style-type: none"> • Positivism (and pos-positivism) • Interpretivism: <ul style="list-style-type: none"> - Symbolic interactionism - Phenomenology - Hermeneutics • Critical inquiry • Feminism • Postmodernism | <ul style="list-style-type: none"> • Experimental research • Survey research • Ethnography • Phenomenological research • Grounded theory • Heuristic inquiry • Action research • Discourse analysis • Feminist standpoint research | <ul style="list-style-type: none"> • Sampling • Measurement and scaling • Questionnaire • Observation: <ul style="list-style-type: none"> - Participant - Non-participant • Interview • Focus group • Case study • Life history • Narrative • Visual ethnographic methods • Statistical analysis • Data reduction • Theme identification • Comparative analysis • Cognitive mapping • Interpretative methods • Document analysis • Content analysis • Conversation analysis |

3.3.1 Epistemology

Epistemology is a way of understanding and explaining how we know what we know. Epistemology deals with the *“the nature of knowledge, its possibility, scope and general basis”* (Hamlyn 1995) and *“is concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate”* (Maynard 1994). Crotty (1998) identifies three main epistemological positions and describes them as follows:

1. **Objectivism** sustains that things exist as meaningful entities independently of consciousness and experiences. Truth and meaning reside in the objects. Therefore, meaningful reality exists as such apart from any consciousness. Under this epistemological point of view, the objective truth can be unveiled because understandings and values are objectified in the people being studied;
2. **Constructionism** is diametrically opposed to objectivism. Constructionism sustains that there is no objective truth waiting to be discovered because the subject and object emerge together in the generation of meaning. That is, meaning is a consequence of the mind and cannot exist without it. Meaning is not discovered, but constructed; and

3. **Subjectivism** is similar to constructionism, but with the difference that in the former the meaning is imposed into the object by the subject rather than coming out of *'interplay'* between subject and object as in the latter. In subjectivism the object does not contribute at all to its meaning.

This research identifies itself with the constructionist epistemological position as it deems different people will construct different meanings of the same phenomenon. Therefore, and because of this adopted epistemological position, this research does not unveil an objective truth. Instead, it explores *"the humanly fashioned way of seeing things"* (Crotty 1998).

At the epistemological level, this study is about the process of meaning making, rather than unveiling a meaning independent to any consciousness (positivism). On the other hand, the meaning is not independent to the subject (objectivism), but constructed together with the object. Whilst some researchers seek objective and universally generalisable conclusions, human knowledge is not like that. *"At best, our outcomes will be suggestive rather than conclusive. They will be plausible and helpful ways of seeing things, but certainly not any 'one way' of seeing things"* (Crotty 1998).

The idea that appropriate methods will unveil an objective truth is starting to shift, in some areas, by the view that *"all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context"* (Crotty 1998).

3.3.2 Ontology

Parallel to epistemology (also informing the theoretical perspective) is ontology. Ontology is the study of *'being'*, of the *'what is'* with the nature of existence. In ontology, realism sustains that reality exists outside the mind. This research shares the point of view that the world (and things in the world) exists independently of our consciousness of them. Thus, the research holds realism as its ontological position.

Crotty (1998) points out that some authors (e.g. Creswell 1994) establish a necessary link between objectivism in epistemology and realism in ontology. Thus, realism ontology is compatible only with objectivism epistemology, not constructionism. This renders the adopted constructivism epistemological position of the research incompatible with its realism posture in ontology.

Nevertheless, Crotty (1998) challenges such traditional posture and notes that *"realism in ontology and constructionism in epistemology turn out to be quite compatible"*. Whilst he agrees that there is a world independent of the consciousness: *"the world is there regardless of whether human beings are conscious of it"*, he sustains that the world only becomes a world of meaning when meaning-making begins to make sense of it. Existence of a world without a mind is conceivable. Meaning without a mind is not. Therefore, it is possible for this research to adopt realism in ontology and still be compatible with its constructionism epistemology.

3.3.3 Theoretical perspective

The theoretical perspective (next level down from epistemology) is the philosophical stance behind the methodology and providing a context for the process as well as grounding its logic and criteria. It is an approach to understand and explain society and the human world. As a consequence, the adopted theoretical perspective will generate a number of assumptions that will impact in the methodology (Crotty 1998).

From the list of options shown on Table 3.2 above, positivism is ruled out as a theoretical perspective because positivism is objective by definition and requires a thoroughly objectivist epistemology (Crotty 1998).

On the other hand, since interpretivism looks for culturally derived and historically situated interpretations of the social life-world, it is the adopted theoretical perspective in this study. Interpretivism emerged in contradistinction to positivism; as a reaction to the effort of making natural science out of the social (Schwandt 1994; Crotty 1998).

Max Weber, the founder of interpretivism, suggests that human sciences are concerned with '*Verstehen*' (understanding) focusing in the explicative approach, as opposed to '*Erklaren*' (explaining) used in the natural sciences which focuses on the causality. The different methods employed by each lead to the distinction between qualitative and quantitative research methods. However, the debate on whether human and social sciences should use different methods from that of the natural sciences predates Weber (Crotty 1998).

Philosopher Wilhelm Windelband pointed out a logical distinction between natural and social reality which is originated by the different point of view used in each case. In the case of nature, science is after consistencies, regularities, the '*law*' (nomos). On the other hand, human affairs are concerned with the individual '*case*' (idios). As a consequence, natural science seeks what Windelband refers to as nomothetic, whilst the human and social sciences seek idiographic knowledge (Crotty 1998).

Based on this distinction, Heinrich Rickert sustains that natural sciences should use '*generalising*' methods in order to establish general laws over and against an individualising method for the human and social sciences, which isolate individual phenomena in order to trace their unique development. In contrast, social research more often than not, tends to focus on precisely those unique, individual and qualitative aspects (Crotty 1998).

However, it is Weber's point of view that both types of sciences, the natural and the human and social, may be concerned at any given time with either the nomothetic or the idiographic (Crotty 1998).

Interpretivism has three streams (Crotty 1998):

1. **Hermeneutics:** has its origins in biblical interpretation;
2. **Symbolic interactionism:** believes that our understandings are affected by culture; and
3. **Phenomenology:** treats culture with caution and suspicion and focuses more in the object.

Phenomenology and symbolic interactionism strongly differ in their understanding of culture as our inherited meaning system. As discussed in Chapter 2, work (what we do and how we do it) is heavily influenced by cultural factors. Therefore, this study could not take place without taking into consideration the strong role that culture plays in shaping today's office environment and so it adheres to the symbolic interactionism stream.

There are three main interactionist assumptions (Blumer 1969):

1. That human beings act toward things on the basis of the meanings that these things have to them;
2. That the meaning of such things is derived from, and arises out of, the social interaction that one has with one's fellows; and
3. That these meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he encounters.

These assumptions (constraints) will be taken into consideration when analysing the results of the research.

3.3.4 Methodology and methods

Next down from the theoretical perspective is methodology, refer to Figure 3.3. Methodology is the strategy behind the choice of particular methods. The methodology inherits all the assumptions established in the epistemology, ontology and theoretical perspectives as previously discussed (Crotty 1998).

In Crotty's (1998) model, the distinction between qualitative and quantitative research occurs at the level of methods, not at the level of epistemology or theoretical perspective. This model challenges the widely spread conception that objectivist research must use quantitative methods whilst subjectivist research must limit to qualitative methods. Quantification is by no means ruled out within non-positivist research. Any rules that apply are between epistemology and theoretical perspective (first two columns of Table 3.2 above). Between these two columns the relationships are limited (one cannot be objectivist and interpretivist at the same time).

The quantitative paradigm comes from an empiricist tradition established by Comte, Mill, Durkheim, Newton and Locke (Smith 1983). It is an *"inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers, and analysed with statistical procedures, in order to determine whether the predictive generalisations of the theory hold true"* (Creswell 1994). On the other hand, the qualitative paradigm is a countermovement to the quantitative tradition which began in the late 19th century with Dilthey, Weber, and Kant (Smith 1983) and it is an *"inquiry process of understanding a social or human problem based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting"* (Creswell 1994).

Creswell (1994) labels experiments and surveys as quantitative methods and summarises qualitative methods in ethnography, grounded theory, case studies and phenomenological studies. Creswell sustains that a single paradigm, qualitative or quantitative, should be used as *"using both paradigms in a single study can be expensive, time-consuming, and lengthy"*. On the other hand, Crotty sustains that a research *"can be qualitative or quantitative, or both qualitative and quantitative, without this being in any way a problem"*.

Without making the distinction between quantitative or qualitative methods, Yin (1994) identifies five main different ways of collecting and analysing data, refer to Table 3.3. Yin declares that despite each strategy having its distinctive characteristics, there is not a well defined boundary when to use which. The goal is to avoid gross misfits and chose a method that has a clear advantage over the others based on the type of question being posed, the degree of control over events and the need for a contemporary or historical focus (Yin 1994).

Table 3.3. Research strategies (Yin 1994).

| Strategy | Research question | Requires control over behavioural events | Focuses on contemporary events |
|-------------------|--------------------------------------|--|--------------------------------|
| Experiment | How, why | Yes | Yes |
| Survey | Who, what, where, how many, how much | No | Yes |
| Archival analysis | Who, what, where, how many, how much | No | Yes / no |
| History | How, why | No | No |
| Case study | How, why | No | Yes |

Based on the above and as further explained in section 3.3.5 *Survey*, survey is the methodology adopted by this research. However, as explained in Chapter 6, the test of the research instrument (Chapter 5) indicated that a complementary method (case study) needed to be implemented in order to obtain data beyond the limitations of the survey.

Figure 3.3 shows a summary of the research approach based on Crotty's (1998) structure.

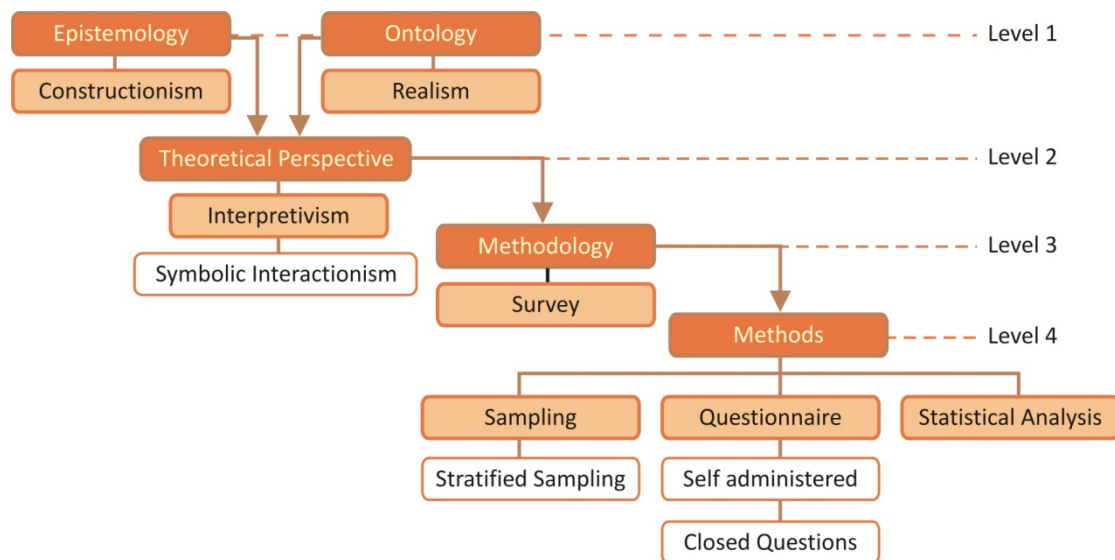


Figure 3.3. Summary of research approach

3.3.5 Survey

Survey research is a methodology of social research based on structured or systematic sets of data collected about the same variable from at least two cases, with the results presented in a data matrix that allows comparison and analysis of such data (Vaus 1995). A survey provides a numeric description of some fraction of the population, known as the sample, through the data collection process of asking questions to people in such a way that allows the researcher to generalise the findings to the population (Creswell 1994; Fowler 2002).

Due to the frequent use of questionnaires in surveys, it is commonly believed that the one is related to the other. However, the distinguishing trait of surveys is not the use of questionnaires. Surveys might also include other techniques such as structured and in-depth

interviews, observation, and content analysis amongst others. The form of data collection and the method of analysis are what define a survey (Marsh 1979).

Like any other methodology mentioned in Table 3.2 above, surveys have disadvantages. Following is a synthesis of philosophical and technical criticism of surveys (Vaus 1995).

- Surveys cannot adequately establish causal connections between variables.
- Surveys are incapable of getting at the meaningful aspects of social action. Because actions are the actions of conscious people who make choices, have memories, wills, goals, and values which motivate behaviour.
- Surveys just look at a particular aspect of people's belief and actions without looking at the context in which they occur.
- Surveys assume that human action is determined by external forces and neglect the role of human consciousness, goals, intentions and values.
- Survey research is a sterile, ritualistic and rigid model of science centred around hypothesis testing and significance tests, which involves no imagination or creative thinking.
- Survey research merely collects a mass of facts and statistics and provides nothing of theoretical value.
- Some things are not measurable, especially by surveys.
- Surveys are too restricted because they rely on highly structured questionnaires which are necessarily limited.
- Surveys are too statistical and reduce interesting questions to totally incomprehensible numbers, making statistics the master of surveys instead of the servant.

These limitations are not only taken into account in Chapter 4 whilst developing the research instrument in order to overcome or minimise their effect, but are also noted as part of the research's limits and constraints which will be taken into account (together with the other research design and approach constraints) when generating conclusions. Still, and in spite of its disadvantages, survey research is probably the best known and most widely used research methodology in the social sciences (Babbie 1990).

3.3.5a Type of Survey

The type of survey used in this research is a cross-sectional survey. That is, data from the sample is collected at only one point in time. As a consequence, the survey describes the population at only such time (Babbie 1990). Cross-sectional surveys do not have a time dimension (Vaus 1995).

It is noted that a longitudinal survey (that which allows the analysis of data over time) would have been useful to study the differences in the workplace through time. However, the time frame available in a PhD research is not sufficient to record such changes. Whilst there are techniques to approximate a cross-sectional survey to a longitudinal survey, the techniques are risky as respondents might not provide reliable information (especially to earlier data). Further, approximating techniques cannot be taken as a cross-section of the population at the time because the sample is limited to the present population only (Babbie 1990). Thus given that the data '*lives*' in the past, the best way to resolve the problem was to turn to the literature and statistics of other studies as needed.

3.3.5b Survey Sampling

Due to the cost and impracticality of collecting information from everyone in a group, data from only some people reflecting the characteristics of such group is more efficient than

surveying all members of the group (Vaus 1995). Sampling is a survey method that uses a segment of the population in order to make estimated assertions about the nature of the total population from which the sample has been selected (Babbie 1990).

Sample surveys can be more accurate than interviewing every member of the population. There are two main reasons for this paradox. First, the quality of the data collected in a large survey is usually lower than the one obtained in a smaller one. Second, a large population requires a long interviewing period which makes impossible to specify the time to which the data refer (Babbie 1990; Fowler 2002).

Sampling requires finding a way to give all, or nearly all, population members the same, or a known, chance of being selected (Fowler 2002). Since survey samples must accurately represent the populations from which they are drawn to provide useful estimates of the characteristics of that population, the highest risk is that the selected sample misrepresents the population from which it belongs. Therefore, conscious and unconscious sampling bias must be avoided. Methods like Simple Random Sampling (SRS), systematic sampling, stratified sampling and multistage cluster sampling vary from literally '*pulling names out of a hat*' to more structured methods to ensure that all elements in the population have unbiased and equal chance of selection (Babbie 1990; Vaus 1995). Non-probability sampling methods like judgmental sampling or quota sampling have been discarded from this study as they do not offer the level of accuracy required.

Stratified sampling is a modification of SRS and systematic sampling that produces accurate representative samples. This method reduces the risk of distortion due to the under-representation of groups within the population. Stratified sampling uses a homogeneous population which produces samples with smaller sampling errors than a heterogeneous population (Vaus 1995). This is achieved by organising the population into homogeneous subsets (with heterogeneity between subsets) and selecting the appropriate number of elements from each subset. The choice of stratification variables are prioritised by those that are strongly related to variables that need to be accurately represented in the research (Babbie 1990).

It is relevant for the study to understand if there are differences in the work environment and working habits between professions. For this, two distinctive professions will be studied: Designers and Accountants. Similarly, it is important to know if there are differences between offices located in the Central Business District (CBD) and the Suburbs. Thus, the stratifying variables are as per Table 3.4.

Table 3.4. Stratifying variables.

| Stratifying variable | Strata |
|----------------------|--|
| Profession | <ul style="list-style-type: none"> Designers Accountants |
| Location | <ul style="list-style-type: none"> Central Business District (CBD) Suburbs |

Table 3.5 shows the result of combining both stratifying variables.

Table 3.5. Stratifying variables matrix.

| | City | Suburbs |
|-------------|------------------|---------------------|
| Designers | Designers-City | Designers-Suburbs |
| Accountants | Accountants-City | Accountants-Suburbs |

The key to stratified sampling is the way people are organised in the sampling frame. The sampling frames are ordered into groups according to the category of the stratifying variable and then, by systematic sampling, the appropriate proportion of people is selected within each strata (Vaus 1995).

3.3.5c Size of the sample

Vaus (1995) defines the size of the sample as the result of the degree of accuracy required for the sample and the extent to which there is variation in the population in regard to the key characteristics of the study.

There are three main characteristics about the sample size and accuracy (Vaus 1995):

1. It is the absolute size of the sample that is important. That is, the size of the population from which we draw the sample is largely irrelevant for the accuracy of the sample. Except, when the sample size represents a sizable proportion of the population (10 %) in which a slightly smaller sample is equally accurate;
2. Within small samples, a small increase in sample size leads to a substantial increase in accuracy. However, increasing the samples in larger samples does not increase the accuracy in the same proportion, refer to Table 3.6. Beyond a certain point, the effort of increasing the sample size is not worth it in terms of the extra precision;
3. A more homogeneous sample achieves a higher accuracy level. That is, for a population in which most people (or very few) will answer a question in a particular way, a smaller sample is acceptable.

Table 3.6. Required sample sizes (Vaus 1995).

| Acceptable sampling error | Per cent of population expected to give particular answer | | | | | |
|---------------------------|---|----------|----------|----------|----------|--------|
| | 5 or 95 | 10 or 90 | 20 or 80 | 30 or 70 | 40 or 60 | 50/50 |
| 1% | 1,900 | 3,600 | 6,400 | 8,400 | 9,600 | 10,000 |
| 2% | 479 | 900 | 1,600 | 2,100 | 2,400 | 2,500 |
| 3% | 211 | 400 | 711 | 933 | 1,066 | 1,100 |
| 4% | 119 | 225 | 400 | 525 | 600 | 625 |
| 5% | 76 | 144 | 256 | 336 | 370 | 400 |
| 6% | | 100 | 178 | 233 | 267 | 277 |
| 7% | | 73 | 131 | 171 | 192 | 204 |
| 8% | | | 100 | 131 | 150 | 156 |
| 9% | | | 79 | 104 | 117 | 123 |
| 10% | | | | 84 | 96 | 100 |

In order to allow subgroup analysis, the sample needs to be sufficiently large so that when it is broken down into separate subgroups there will be sufficient elements in each one. As a rule of thumb the smallest subgroup has to have at least 50 (Hoinville and Jowell 1977; Vaus 1995). Therefore, to allow subgroup analysis the research sample size for this study needs to be as per Table 3.7.

Table 3.7. Required sample size for sub-group analysis.

| Group | Sub-groups | Minimum sample size |
|-------------|---------------------|---------------------|
| Designers | Designers-CBD | 50 |
| | Designers-Suburbs | 50 |
| Accountants | Accountants-CBD | 50 |
| | Accountants-Suburbs | 50 |
| Total | | 200 |

3.3.5d Response Rate and Non-Responses

Response rate is the number of people interviewed (respondents) divided by the number of people sampled. Although there is no agreed-upon standard for a minimum acceptable response rate a response rate of at least 50% is generally considered adequate for analysis and reporting, a 60% response is good and 70% is very good (Babbie 1990).

The problem of a low response rate (5% to 20 %) is that the sample has little relationship to the original sampling process. Those responding are essentially self-selected. Therefore, it is very unlikely that such procedures will provide any credible statistics about the characteristics of the population as a whole. Failure to collect data from a high percentage of those selected to be in a sample is a major source of survey error (Fowler 2002). According to Fowler, there are three different causes of non-respondent:

1. People did not receive the questionnaire;
2. People asked to provide data refuse to do so; and
3. People are unable to perform the task required of them.

According to Vaus (1995) non response creates two problems. The first is an unacceptable reduction of sample size. Whilst this problem could be minimized by using techniques designed to reduce non response, even with good techniques in place there is about a 20% non-response. Therefore, the (minimum) recommended sample size for this study is $200 + 20\% = 240$ (20% larger than the goal sample size). It is worth noting that this figure later increased to 284 (71 per sub-group) due to the response rate achieved during the test of the survey (refer to Chapter 5 and 6).

The second problem created by non-respondents is bias. Even if the goal sample is achieved by increasing the initial sample as above, non-responders present a more challenging problem. Non-responders are systematically different from the whole population. Leaving a group of people out (whose characteristics are unknown) renders the survey biased. A way to overcome this problem is to identify what the bias is (characteristics of this group) and to what extent it occurs (Babbie 1990; Fowler 2002; Vaus 1995). Babbie (1990) sustains that demonstrating lack of response bias is far more important than achieving a high response rate.

The nature of bias associated with non-response differs amongst mail, telephone, online and personal interview procedures. In the case of mailed surveys (the adopted method), it is people who have a particular interest in the subject matter or the research itself that are more likely to return mail questionnaires. A mail survey with low response rates may be significantly biased in ways that are related directly to the purpose of the research. Other consistent bias in mail surveys is that better-educated people often send back questionnaires more quickly than those with less education. All in all, it is difficult to predict when, and how much, non response will or will not affect survey estimates (Fowler 2002).

Lacking any other clear information that might arise during the questionnaire administration time, a return graph is the best way to estimate non-response biases in the survey. This is because it is reasonably safe to assume that respondents who fail to answer the questionnaire will be more like those who delayed answering than those who answered right away (Babbie 1990).

3.4 SUMMARY

The research questions and sub-questions are:

- **To what extent is information technology changing workplace architecture?**
 - Will there be a change in the *type* of office space required in the future?
 - Will there be a change in the *amount* of office space required in the future?
- **How is IT changing workplace architecture?**
 - *Why* is IT changing space requirements in the office environment?
 - *How* will the office of the future be like?

The adopted research epistemology is constructionism, its ontology realism, its theoretical perspective interpretivism, the methodology survey, and the methods are stratified sampling, self administered questionnaire with closed questions.

Designers and accountants in city and suburbs are the groups selected for analysis.

The following chapter explains the design of the research instrument required to collect data needed to address the research questions.

DEVELOPMENT OF THE RESEARCH INSTRUMENT

CHAPTER

4

4.1 INTRODUCTION

This chapter reviews the theory behind the development, justification and administration of the research instrument and discusses specific design guidelines for self-administered questionnaires in order to increase the reliability and validity of the findings of the research. The objective of this chapter is to develop a research instrument and administration process to collect the data required to respond the research questions.

The first section of the chapter discusses the design of the survey. The second part reviews the analysis techniques that will be used to understand the collected data. Finally, the third section develops the reporting techniques for the collected data.

It is important to note that the questionnaire developed in this Chapter was revised in Chapter 6 following the testing process described in Chapter 5.

4.2 RESEARCH INSTRUMENT DESIGN GUIDELINES

“Reducing measurement error through better question design is one of the least costly ways to improve survey estimates.”

Fowler (2002)

A question in a survey instrument is not a conversational inquiry, but a means to obtain a measure. Its counterpart, the survey answer, has no intrinsic value because it is a response evoked in an artificial situation contrived by the researcher. A survey answer is valuable only to the extent that it has a predictable relationship to facts or subjective states that the researcher is trying to measure (Fowler 2002). A good questionnaire is one that produces truthful, accurate answers. In order for answers to be good measures, they need to be reliable and valid (Bradburn *et al.* 2004).

4.2.1 Reliability

Reliability is a matter of whether a particular technique (in this case a question) applied repeatedly to the same object, would produce the same result each time (Babbie 1990). Thus, a question is reliable when two respondents that are in the same situation answer it in the same way. Otherwise, random error is introduced making the measurement less precise (Fowler 2002).

The following design guidelines proposed by Babbie (1990), Fowler (2002) and Bradburn *et al.* (2004) for self-administered questionnaires were adopted in the design of the questionnaire to increase its reliability.

- **Standardised instrument:** Survey research makes the necessary assumption that differences in answers derive from differences amongst respondents, rather than from differences in the stimuli to which respondents are exposed. In order to best

measure the former over the latter, the proposed questionnaire is designed so that all questions mean the same to all respondents. Otherwise, two respondents could provide different answers to the same question just because they understand it differently.

- **Sensible questioning:** Respondents are asked only questions they are likely to know the answer to, and that are relevant to them. This will not only improve the reliability of the questionnaire, but increase the response rate by increasing the interest of the respondent.
- **Closed questions:** Survey questions can be classified in those for which a list of acceptable responses is provided to the respondent, known as closed questions, and those for which no list is provided to the respondent, known as open questions. Whilst open questions allow the researcher to obtain unanticipated answers and the respondent to describe with their own words more closely their point of view, this type of questions has the risk of the answers being incomplete, vague, and difficult to code. Thus, open ended questions are of limited value as measurements. As a result, respondents in this study are asked to choose from a pre-defined list of responses.
- **Worst and least desirable first:** When providing the list of possible responses (closed questions, as mentioned above) it is usually better to list responses from the lowest (or worst) level to the highest (or best) level. Likewise, it is better to start with the end of the scale that is the least desirable; otherwise the respondent might choose one of the first categories without reading the other options.
- **Even number scales:** Four point scales can more effectively discriminate answers because there is not a neutral option. If presented with an even number of response categories, respondents who feel in the middle must lean towards one end or the other of the distribution.
- **Reduction of ambiguity by definition of complex terms:** Respondents tend to answer questions even though the questions include ambiguous terms. This produces distorted data. To overcome this problem, a definition of unclear or ambiguous terms is provided in the proposed survey where required.
- **Single questions:** When respondents are faced with two questions in the same sentence, they need to decide which to answer. Because such decision is made inconsistently by different respondents, the questionnaire becomes unreliable. This problem is overcome by the use of contingency questions as explained in the next point.
- **Contingency questions:** To avoid double questions (above) of when certain questions are relevant only to a subset of the respondents, the correct use of contingency questions facilitates answering the questionnaire and improves the quality of the data produced. Contingency question means that a second question is contingent dependant) upon the response of the first. Arrows or “go to” can be used to point the respondent to the next applicable question.
- **Simple and short:** If there is the possibility for the respondents to get confused about what they are supposed to do, they will be. Therefore, the instrument is as simple as possible. Checking a box is the only task required in the questionnaires. Parallel, long surveys result in poor response rates, careless answers, and useless results. Thus, the questionnaire is as short as possible. The quantity and quality of questions asked is strictly limited to the information required. “*Wouldn’t it be interesting to know*” questions were avoided.
- **Order of questions:** Since respondents will try to answer later questions consistently with prior assessments, the order in which questions are asked can affect the responses and the overall data collection. However, trying to randomise the questions

will only confuse the respondent (with the associated risk of not finishing the survey) and does not eliminate the effect. Thus, the order of the questions needs to be carefully planned. Demographic data like age, sex, etc. is placed at the end of the questionnaire in order to avoid the impression of a routine form, which can affect the motivation of the responder to complete the questionnaire. The questionnaire starts with appealing set of questions, yet not complicated, to create curiosity which increases the likelihood of the questionnaire being fully answered.

In order to increase reliability (or monitor it), Berge (1989) suggests that in addition to essential questions geared to obtain specific information, extra equivalent but worded differently questions are also included in the questionnaire. Then, by comparing responses across similar questions the level of reliability could be determined. Enticed by the advantages of this method, this approach was adopted in the preliminary draft of the survey. However, it soon proved to considerably increase the length of the survey which could result in a lower number of responses. It was considered that the disadvantages of this approach outweighed the advantages and this option was abandoned.

4.2.2 Validity

Validity refers to the extent to which an empirical measure adequately reflects the '*real meaning*' of the concept under consideration (Babbie 1990). Validity deals with the issue of what a given answer means in relation to what the study is trying to measure and tries to improve the correspondence between answers and true values (Fowler 2002).

As previously mentioned in Chapter 3, variance questions in this research aim to state that 'x' is related to 'y' via 'z'. In order to best measure the research variables, Babbie (1990) recommends the use of scales and indices as data-reduction devices that allow the researcher to summarise in a single score the respondent's several responses, whilst maintaining the specific detail of those responses. The importance of indices and scales relies on the fact that any single item is likely to misrepresent some of the respondents in the study. For example, in attempting to measure religiosity, the frequency of church attendance is probably not sufficient in and of itself. This is because some respondents who attend church frequently might nevertheless be judged irreligious on other grounds. On the other hand, some who never attend church might be judged religious (Babbie 1990). In the same way and under the context of this research, establishing the respondent's level of technology adoption by a single question like: '*Do you have a computer?*', could lead to a wrong conclusion.

As suggested by Babbie (1990) the following guidelines were observed whilst constructing indices:

- **Unidimensionality:** Composite measures only represent one dimension of a concept.
- **General vs. Specific:** Special attention was given to nuances in general dimensions to be measured. The nature of the items included determines how specifically or generally the variable is measured.
- **Variance:** The proper amount of variance is provided so that it allows the researcher to classify different respondents.

4.2.2a Technology index

As previously mentioned in Chapter 2 there are differences on how ICT is adopted. Figure 4.1 and Figure 4.2 show the different trends in the rate of adoption. This study must be able to identify the level of adoption by profession (Designers / Accountants), location (City /

suburb) and company size; and then compare such level of adoption against the work environment and working habits of such company.

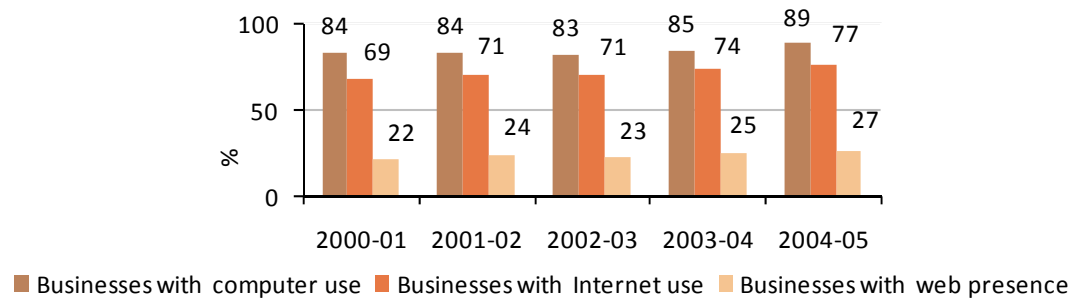


Figure 4.1. Adoption of IT in Australia (ABS-8129.0 2006).

Figure 4.2 shows the relationship between the size of the company (in terms of employee and revenue) and the level of adoption of ICT. Note that the level of adoption of ICT (in all sectors) increases with the size of the company.

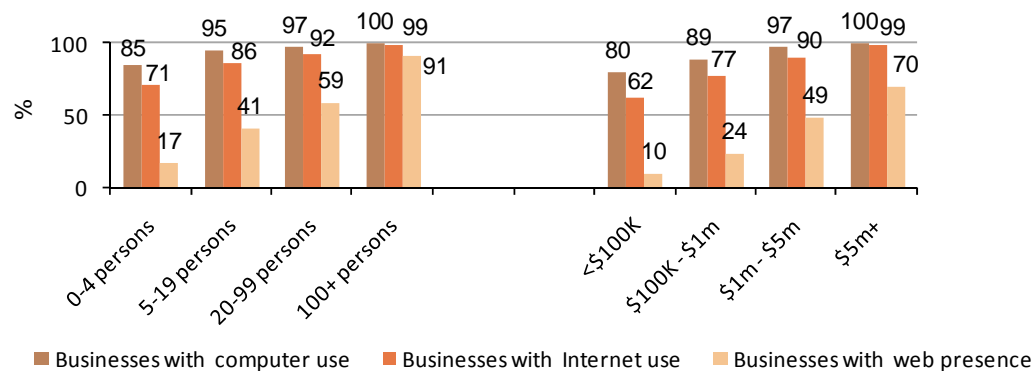


Figure 4.2. Adoption of IT per size of business as at 2005 (ABS-8129.0 2006).

The technology index identifies the level of technology embraced by the respondent. It is important to note that this measurement does not aim to be an absolute indicator of the level of technology affinity, but an indicator of the relative inclination towards technology. This will allow us to classify respondents into more technology oriented and less technology oriented.

This index is constructed based on the correlation between the responses given to answers, or as defined by Babbie (1990), by their empirical relationship. That is, if two items are empirically related to each other, it can be argued that each reflects the same variable, and therefore both can be included in the same index. Therefore, it is expected that respondents who answer in a particular way one question will be more likely to answer the next one in an expected way. This provides a correlation between the responses given to answers. Based on that, respondents can be classified by their technology orientation. The technology index is conformed by the questions summarised in Table 4.1.

Table 4.1. Technology index questions.

| Question | Predecessor |
|---|-----------------|
| 1 Do you use a computer at work? | n/a |
| 2 Do you use a PC or Mac computer? | 1 |
| 2.P.1 What is your computer's microprocessor (CPU)? | 2 |
| 2.M.1 What model is your computer? | 2 |
| 2.P.2 Which software and version of word processor is used at your workplace? | 2.P.1 |
| 2.M.2 Which software and version of word processor is used at your workplace? | 2.M.1 |
| 3 Does your workplace have Internet connection? | 1, 2.P.1, 2.M.1 |
| 4 Does your company have a website? | 3 |
| 5 Which scenario best describes the adoption process of technology in your workplace? | 4 |

The type of empirical relationship used for the indices is bivariate. As the prefix '*bi*' denotes, it refers to the empirical relationship between two variables. Nevertheless, this relationship does not mean that respondents will answer two sets of question identically, but that their answer to each question would be consistent with their opinion (Babbie 1990).

There are two common problems that arise when using bivariate relationships. The first, items are not empirically related to one another, thus they do not measure the same variable. The second, the complete opposite, when both items are perfectly related to one another, so only one of them is necessary (Babbie 1990). Care was taken to avoid falling into either of these extremes.

Each response is assigned either an A, B, C or D value depending on how it relates to the level of technology adoption, refer to Figure 4.3. Where A is the highest and D the lowest level. This classification is later used to map the respondents' overall adoption of technology.

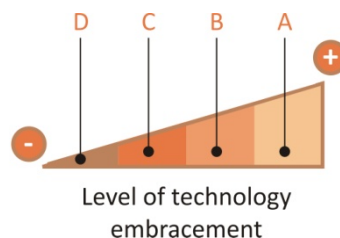


Figure 4.3. Level of technology embracement scale.

Following is a discussion on the rationale of each of the questions presented on Table 4.1 above and the ranking of the responses based on the A to D scale.

Question 1: 'Do you use a computer at work?'

This first question not only serves as a contingency question to filter respondents using a computer from those who do not, but more importantly it serves as the basic benchmark for technology adoption. If participants respond "No" they are assigned a 'D' value and directed to Question 3. If 'Yes', they are assigned an 'A' value and directed to the next question.

Question 2: 'Do you use a PC or Mac computer?'

Since there is no tangible evidence that using a PC or Mac computer indicates a higher or lower level of adoption of technology, this question is used only as a contingency question to

filter different user types. Thus, its answer is of no particular interest and responses to this question will not be analysed nor commented on.

Question 2.P/M.1:

- **2.P.1 ‘What is your computer’s microprocessor (CPU)?’ (PC option)**
- **2.M.1 ‘What model is your computer?’ (Mac option)**

The CPU (Central Process Unit) is the microprocessor of a computer. As mentioned in Chapter 2, the microprocessor speed has exponentially increased since the world’s first microprocessor. Figure 4.4 maps the level of technology adoption of the respondent based on the CPU type. This figure contains most of the commercially available microprocessors released by the major microprocessor companies: Intel and AMD for PC, and Motorola and Motorola-IBM for Mac as at 2006 (date of the design of the research instrument).

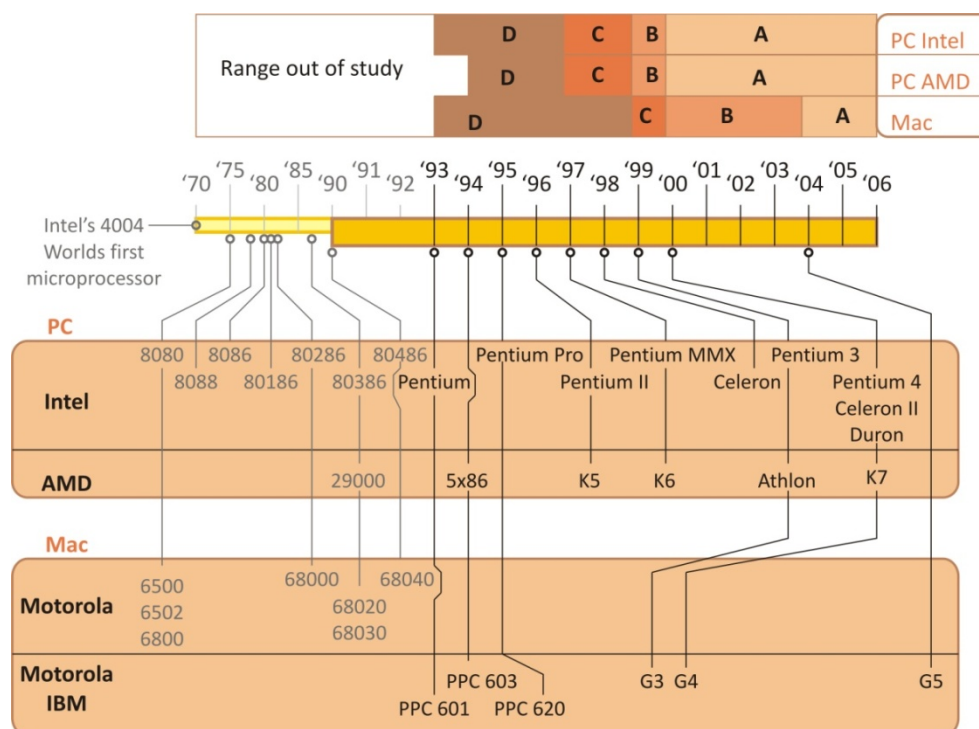


Figure 4.4. CPU table (AMD 2006; ComputerHope 2006; Gilheany 2006; Intel 2006; PCMechanic 2006; Vaughns 2006).

Table 4.2 shows the possible answers to 2.P/M.1 and their associated scale.

Table 4.2. Possible answers to Questions 2.P/M.1.

| Question 2.P.1 (PC users) | Question 2.M.1 (Mac users) | Scale |
|---|----------------------------|-------|
| Pentium, Pentium Pro, Pentium II, 586, K5 | PPC 601, PPC 603, PPC 620 | D |
| Pentium MMX, Celeron, K6 | G3 | C |
| Pentium 3, Athlon | G4 | B |
| Pentium 4, Celeron II, Duron, K7 | G5 | A |

Despite the above being a comprehensive list of CPUs for PC and Mac platforms (as at 2006), 'Other' option is also included as a possible answer for both platforms to allow for new releases. Answers under 'Other' will be mapped and assigned a scale accordingly.

Question 2.P/M.2: 'Which software and version of word processor is used at your workplace?'

Given that word processors allow users to do multiple changes to a document without extensive retyping, check it before printing and store it electronically for later use, they have largely replaced typewriters since the 1980's. Word processing was one of the earliest applications for the personal computer in office productivity. Computers have replaced the typewriter (and the calculator) in the general office and the drawing board in design and engineering offices (Norris 2004; Wikipedia 2006a).

Although there is a vast assortment of software packages for word processing (including open source, proprietary, freeware and online) with over 5 million people using the Microsoft Office suite, MS Word is widely considered the industry standard. This is so, that competitors need to be able to import and export files from/to Microsoft Word's document format to stay afloat (Browne 2006; Wikipedia 2006a).

However, Microsoft Word has not always been the word processor of choice. In the late 1980's and early 1990's WordPerfect, from Corel, was the *de facto* standard word processor. Still, today, WordPerfect has avid users in law firms and a few universities and still in 2005 managed to license 50,000 seats of WordPerfect Office 12 to the United States Department of Justice. However, WordPerfect sales never recovered from failing to produce an earlier Windows version and from the aggressive marketing of Word as part of the Microsoft Office application suite (Corel 2006; Wikipedia 2006a). Table 4.3 lists the most common word processors available as at 2006.

Table 4.3. List of word processors (Browne 2006; Wikipedia 2006a).

| Type | Software |
|-------------|---|
| Open source | AbiWord, EZ word, GNU TeXmacs, Groff, Kword, Lyx, OpenOffice.org Writer, Ted |
| Proprietary | 602 Text, Ability Writer, Apple Works Word Processing, Applix Word – Linux, Ashampoo Office TextMaker, Atlantis Ocean Mind, Easy Word, Evermore Integrated Office, FrameMaker, GoBeProductive, Han/Gul, Lotus Word Pro, Mellel, Microsoft Word, Microsoft Works, Nisus Writer, Pages, Papyrus, PolyEdit, SoftMaker TextMaker, StarOffice Writer, Techdigm Office Word, TextMaker, ThinkFree Office write, WordExpress, WordFile4ME, WordPerfect, Xoom Office Word Pro |
| Freeware | Zoho Writer, Writely, Atlantis Nova, CryptEdit, Delphad, Hieroglyph, Jarte, Madhyam, Qjot, RoughDraft, WordPad |
| Online | Ajax Write, Writely, FlyWord, Thinkfree Online Write, Zoho beta Writer, Rallypoint |

Including the above list in the survey will most likely overwhelm respondents and reduce the return rate. Thus, the most popular word processor softwares for PC and Mac platforms have been selected as per Figure 4.5.

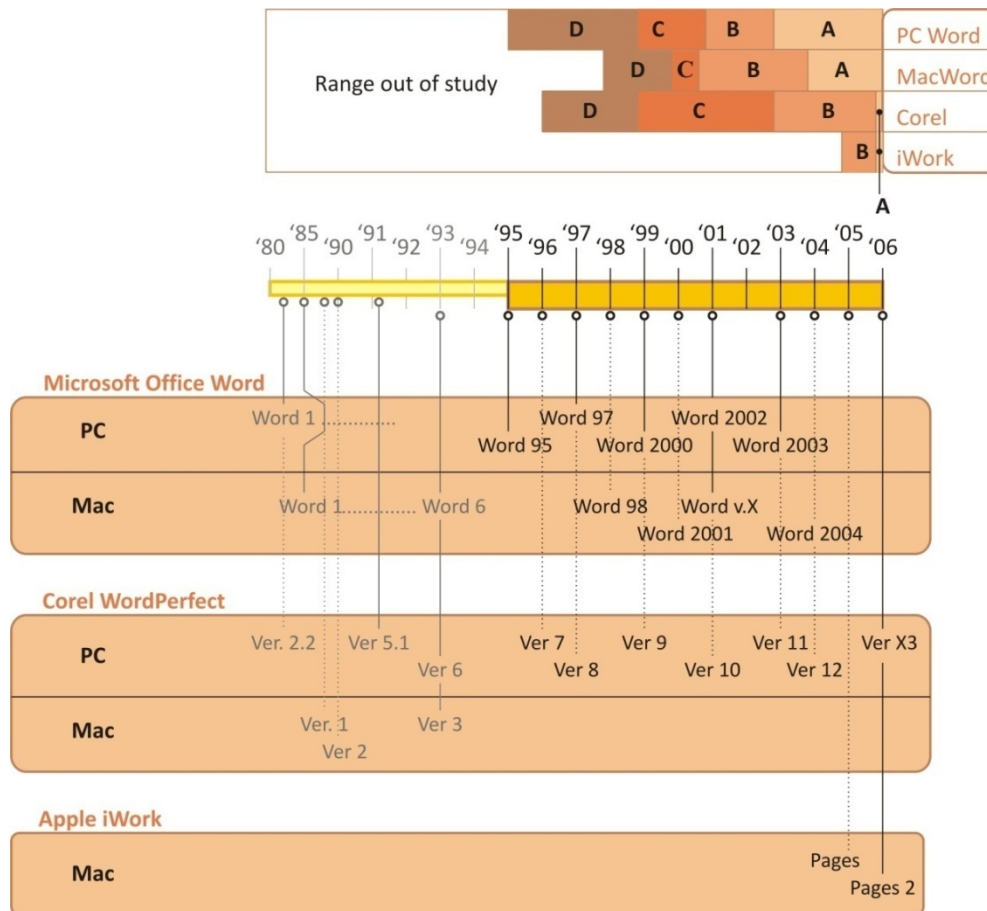


Figure 4.5. Word processor table (Browne 2006, Wikipedia 2006a).

Table 4.4 shows the most popular word processors with their technology index scale.

Table 4.4. Possible answers to Questions 2.P/M.2

| Question 2.P.2 (PC users) | Question 2.M.2 (Mac users) | Scale |
|--------------------------------|----------------------------|-------|
| Word 95-97 / WordPerfect 7-8 | Word 98 | D |
| Word 2000 / WordPerfect 9-10 | Word 2001 | C |
| Word 2002 / WordPerfect 11- 12 | Word v.X / Pages | B |
| Word 2003 / WordPerfect X3 | Word 2004 / Pages 2 | A |

As in the CPU question (above), an 'Other' field is included to allow for other responses.

Question 3: 'Does your workplace have Internet connection?'

Having access to the Internet is a good indicator of technology adoption; further, the type of connection is an indicator in itself. Refer to Figures 4.1 and 4.2 above.

There are two main different types of Internet connections commonly available in Australia: dial-up and broadband.

- **Dial-up:** The Australian Bureau of Statistics (ABS) defines 'dial-up' as an analogue connection to the Internet via modem and dial-up software utilising the public switched telecommunications network (telephone line). As opposed to broadband (see below) it is not an 'always on' connection to the Internet. Although dial-up is

the most economic option (setup and service), it is also the slowest. ISDN (Integrated Services Digital Network) is a digital alternative to an analogue public switched telephone service and can carry voice, video and data. ISDN supports data transfer rates of 64 Kbps. Another version, called B-ISDN is able to support transmission rates of 1.5 Mbps, but requires fibre optic cable and is not widely available in Australia (ABS-8129.0 2006; HelpWithPCs 2006; Whirlpool 2006).

- **Broadband:** As defined by the ABS, broadband is an '*always on*' Internet connection with an access speed equal to or greater than 256kbps. The most common broadband options are: (BroadbandGuide 2006; HelpWithPCs 2006; Whirlpool 2006; Wikipedia 2006b)
 - **ADSL (Asymmetric Digital Subscriber Line):** ADSL became available in Australia in 2000 and it is the most common broadband product in the Australian market. ADSL operates over the existing telephone line without interfering with the normal telephone operation. The most common configurations in the Australian market are:
 - 256Kbps/64Kbps (download speed / upload speed)
 - 512Kbps/128Kbps
 - 1.5Mbps/256Kbps
 - On non-Telstra configurations connection speeds can go up to 24 Mbps/1 Mbps.

The fact that the volume of data is greater in one direction than the other is the distinguishing characteristic of ADSL over xDSL, hence the term Asymmetric. Non-asymmetric configurations like 256/256 and 512/512 SDSL are available in Australia, but cost a little more. One of the biggest ADSL connection disadvantages is that it is not available in all areas, and the hardware cost can be quite significant when compared with the dial-up option.

- **Cable (Fibre optic cable):** Is the second most common broadband product. It operates over the pay TV fibre optic networks installed throughout metropolitan neighbourhoods over the last decade. They are usually very fast and reliable connections. In Australia it is only currently offered by two providers: Bigpond, which uses Foxtel pay television, and OptusNet Cable, which uses Optus pay television.
- **Wireless:** Although new, it is a fast growing technology that allows its users to connect to the Internet without any physical connection. A wireless modem is connected to the computer which communicates via radio signal to a receiver in the neighbourhood. Despite being slower than a physical network, this service is growing rapidly through the capital cities of Australia because of its tangible advantages (internet access at airports, cafes, and virtually anywhere). With the use of directional antennas and on flat areas (no hills) the coverage can be up to 5, or more, kilometres depending on the type of antenna and the strength of the signal.
- **Satellite (HST):** This is the most expensive alternative for getting a high speed connection to the Internet. However, it is the only way to access Internet in rural areas.

If home users are included, dial-up is the most common type of Internet connection available from ISPs (Internet Service Providers) in Australia (Whirlpool 2006). However, for the first time since the ABS started its survey, Broadband was the most prevalent type of Internet connection for businesses across all employment sizes, refer to Figure 4.6 and

Figure 4.7. The proportion of businesses which had broadband as their main Internet connection type grew from 41% to 63% from end of June 2004 to end of June 2005.

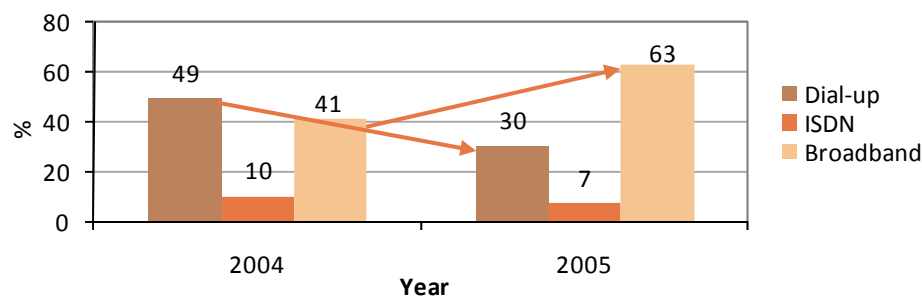


Figure 4.6. Main type of Internet connection in Australia (ABS-8129.0 2006).

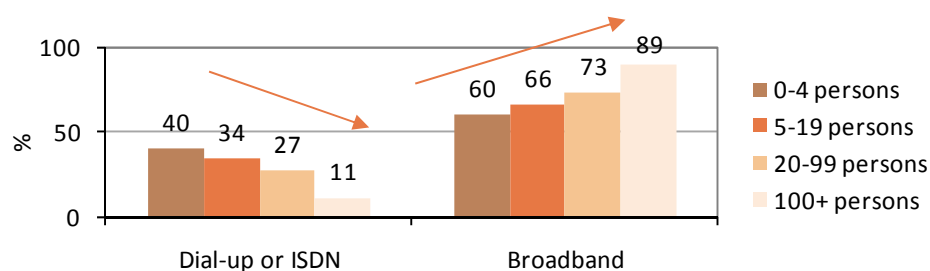


Figure 4.7. Main type of Internet connection by employment size as at 30 June 2005 (ABS-8129.0 2006).

In 2005, 89% of businesses which employed 100 or more persons had broadband as their main connection type. This is a dramatic change as the proportion of businesses with Internet access increased only by 3 percentage points overall (ABS-8129.0 2006).

In its set of statistics (up to 31 December 2005) The Organisation for Economic Co-operation and Development (OECD) noted that on broadband penetration in member countries, Australia has one of the fastest growing rates (along with Iceland, Finland, Norway and the Netherlands) by achieving an increase of more than six subscribers per 100 inhabitants during 2005. This totals an average penetration of 13.56 broadband subscribers per 100 inhabitants. Iceland, Korea, the Netherlands and Denmark achieved a penetration in excess of 25 subscribers per 100 inhabitants. With 49 million subscribers, the US has the largest total number broadband subscribers in the OECD (Corner 2006; OECD 2006).

Based on the above Table 4.5 shows the possible answers to question 3 with their technology index scale.

Table 4.5. Possible answers to Question 3.

| | Scale |
|------------------------------------|-------|
| No internet connection | D |
| Dial-up, ISDN | C |
| Broadband (ADSL, Cable, Satellite) | B |
| Wireless | A |

Question 4: ‘Does your company have a website?’

Having web presence is another indicator of the level of IT adoption. As at 30 June 2005, approximately 27% of Australian businesses reported having a web presence. Refer to Figure 4.1 and Figure 4.2 above.

If a participant responds ‘no’ to this question they are assigned a ‘D’ value and if ‘yes’, they are assigned an ‘A’ value in the technology index scale.

Question 5: ‘Which scenario best describes the adoption process of technology in your workplace?’

Using Rogers’ diffusion of innovation categories, refer to Chapter 2, this final question of the technology index will help to map the respondent’s perceived level of technology embracement. It is important to note that whilst Rogers identifies five types of adopters depending on their readiness and capability to adopt innovation (innovators, early adopters, early majority, late majority and laggards) only four options as described on Table 4.6 are given in the questionnaire. There are two reasons for this. The first one is to be consistent with the scale criteria previously established. Second, as suggested by Bradburn *et al.* (2004), respondents might not be able to discriminate enough to make such scale valuable (Bradburn *et al.* 2004).

Table 4.6. Possible answers to Question 5.

| | Scale |
|---|-------|
| We adopt technology after everyone else | D |
| We adopt technology after the average | C |
| We adopt technology with the majority | B |
| We adopt technology before anyone else in our field | A |

4.2.2b Context index

The technology index cannot be analysed in isolation. The level of technology embracement is affected by the context of the company. Following are the five main context variables that are considered by this study to foster, or hinder, the adoption of technology.

- **C.1 Competitive Environment:** There are two sides to this variable:
 - Competitive environment between companies: On the one hand, organisations under a highly competitive environment are more likely to adopt innovation (in the form of technology and new working paradigms) in the search of a competitive edge.
 - Competitive environment between employees: On the other hand, an employee of an organisation under a highly competitive environment will be less likely to adopt some alternative ways of working (e.g. teleworking). This is mainly because, it is perceived that the lack of visibility within the company might hinder the employee’s advancement. The ‘*out of sight, out of mind*’ effect (Wuorio 2005).
- **C.2 Ecology Awareness:** As commented on Chapter 2, a big beneficiary of alternative ways of working is ecology. Therefore, ecology conscious companies might be more interested in adopting technology that will help the environment. This, in itself, can boost the level of adoption of specific technologies of otherwise less technology oriented companies.
- **C.3 Level of Bureaucracy:** An administrative system in which the need, or inclination, to follow rigid or complex procedures might impede the adoption of innovative ideas

and technology. On the other hand, technology can reduce the perceived level of bureaucracy by doing bureaucratic processes for user in the background.

- **C.4 Company Size:** As previously discussed, larger companies are more likely to adopt more technology earlier than smaller firms. Therefore, the size of the company will be taken into consideration whilst assessing the technology orientation of the company.
- **C.5 Corporate Image:** The image that a company aims to transmit to its clients, peers and competition plays an important factor in the adoption of technology that can impact workplace architecture. As previously mentioned in Chapter 2, companies that cherish the status that buildings offer are less likely to '*go virtual*' than the ones that wish to reflect the image of innovation.

Based on the above, it is expected that the competitive environment between companies, ecology awareness, company size and corporate image have a directly proportional relationship with the technology index. On the other hand, the competitive environment between employees, and the level of bureaucracy are expected to have an inversely proportional relationship with the technology index.

4.2.3 Preliminary survey questions

Parallel to the technology and organisation context index composed by the above listed questions, three more indices relevant to the study were developed and included in the preliminary survey:

- **Office environment index:** measures the office environment satisfaction of the respondent based on a four point scale. The following parameters are measured:
 - A) Temperature comfort;
 - B) Ventilation comfort;
 - C) Illumination comfort;
 - D) Background noise level;
 - E) Frequency of distractions;
 - F) Visual privacy at workstation; and
 - G) Voice privacy at workstation
- **Space index:** measures spatial parameters based on a four point scale. The following parameters are measured:
 - H) General spatial arrangement;
 - I) General furniture arrangement;
 - J) General office size;
 - K) General office storage space;
 - L) Individual storage space;
 - M) Work space available on workstation; and
 - N) Overall space environment satisfaction

Parameters A to N are grouped into question 1, refer to Table 4.7. These parameters together with question 6, 7 and 8 will help to assess how well current office environments satisfy occupants (participants). The information collected will also help to establish relationships (if any) between environment and space satisfaction and the type of building (adapted/purpose designed – question 3), as well as the office layout (enclosed/open – question 4).

- **Organisation context index:** provides information on variables that could affect the level of technology embracement and adoption of AWW as explained in section 4.2.2b *Context index*.

- **Alternative Ways of Working (AWW) index:** measures level of adoption and perceived advantages and disadvantages of AWW. Refer to questions 24 to 24.N.2 of Table 4.7.

Table 4.7 lists the questions that compose the preliminary questionnaire and were tested as further described in Chapter 5. Refer to Appendix 4a for a sample of the questionnaire. The final set of questions used for the final survey is presented in Chapter 6.

Table 4.7. Preliminary survey questions.

| No. | Question | Index |
|--------|--|-------|
| 1 | Evaluate the following parameters at your workplace (A-N): (Temperature, etc.) | Oe/S |
| 2 | From the following list rank the deficiencies that apply to your workplace: (Shortage of space, etc.). | S |
| 3 | In what type of building is your office located? | Oc |
| 4 | Which layout best describes your workplace? | S |
| 5 | On average, people at your workplace are: (Most of the time at their desk, etc.) | Oc |
| 6 | How many meeting rooms are at your workplace? | S |
| 7 | How would you describe the number of meeting rooms? | S |
| 8 | Has any space been adapted to allow for more storage space? | S |
| 9 | How flexible is your workplace about when employees do their work? | Oc |
| 10 | How flexible is your workplace about where employees do their work? | Oc |
| 11 | Do you use a computer at work? | T |
| 12 | Is your computer PC or Mac? | - |
| 12.X.1 | (P) Which is your computer's microprocessor / (M) What model is your computer? | T |
| 12.X.2 | (P/M) Which software and version of word processor is used at your workplace? | T |
| 13 | Does your workplace have Internet connection? | T |
| 14 | Does your company have a website? | T |
| 15 | Is there a wireless network at your workplace? | T |
| 16 | What type of monitors are used at your workplace? | T |
| 17 | Which scenario best describes the adoption process of new technology in your workplace? | T |
| 18 | Does your workplace rely more on faxes or e-mails to receive and send information? | T |
| 18.X.1 | (E) Generally, non-spam e-mails, are? (F) Faxes are received: | Oc |
| 19 | Are hardcopy documents scanned? | T |
| 20 | Are there policies in your workplace to reduce the use of: (Electricity, etc.) | Oc |
| 21 | Rank the level of bureaucracy at your workplace | Oc |
| 22 | Rank the level of competition at your workplace | Oc |
| 23 | On average, how many hours do you work overtime on a fortnightly basis? | Oc |
| 24 | Does your workplace have implemented AWW? | A |
| 24.Y.1 | Do you personally work in the above selected arrangement? | A |
| 24.N.1 | Could most of your work be done outside an office environment? | A |
| 24.Y.2 | Which pros and cons have you experienced as a consequence of adopting AWW? | A |
| 24.N.2 | Which do you think would be the most common pros and cons of adopting AWW? | A |
| 25 | On average how much time takes you to get to work? (Return) | Oc |
| 26 | How do you get to your workplace? | Oc |
| 27 | How many people work at your company? (Including yourself) | Oc |

Oe
Office environment
Index

S
Space
Index

Oc
Organisation
context Index

T
Technology
Index

A
AWW
Index

4.3 QUESTIONNAIRE FORMAT

Fowler (2002) argues that the procedures used to collect data are as important as the sample selection process in determining how well data from a sample describe a population. Initial assessment was done to determine whether the questionnaire should be paper based (and mailed to participants) or applied online (using a web based interface). The online survey offered clear advantages in its distribution, application, data management and overall administration process. Moreover, the complexities and challenges of the data entry process as further explained in Chapter 7 are avoided when using online surveys.

However, as previously discussed, the level of IT adoption varies across industries and company size. Thus, it was considered that using an online survey could introduce bias to the study because more IT oriented companies would be more likely to participate. This could have misrepresented the true level of IT adoption. It was then considered that a paper based questionnaire could reduce this type of bias. The implications of this decision are further discussed in Chapter 7.

The format of the questionnaire (how it looks) is as significant as the nature and wording of the questions asked (Babbie 1990) and influences the quality of the data (Sanchez 1992; Bradburn *et al.* 2004). Generally speaking, almost anything that makes a mail questionnaire looks more professional, personalised, attractive and easy to answer will have a positive effect on response rates (Fowler 2002; Bradburn *et al.* 2004). The following considerations were taken into account whilst designing the format of the questionnaire (Babbie 1990, Bradburn *et al.* 2004, Fowler 2002, Sanchez 1992):

- **Font:** A clear and sufficiently large font style is important to be easily read by all potential respondents. Arial (a sans-serif font) size 11 was selected for the body of the questionnaire.
- **Spacing:** Squeezing several questions in one page in order to prevent it from looking too long reduces response rates when compared with the same number of questions attractively spaced over more pages. The use of 'white space' should be balanced.
- **Instructions:** There is no agreed opinion whether a questionnaire should have instructions or not. Some authors sustain that every questionnaire should have instructions. On the other hand, other authors argue that instructions should not be used, because they will not be read consistently. However, basic instructions were provided in the questionnaire. Following the Bradburn *et al.* (2004) recommendations, instructions were put at the point in the questionnaire where they would be used.
- **Question layout:** Each question, including all its answers, must be on the same page. Special care must be taken not to put a short question at the end of the page after a long question as it is likely to be omitted in error.
- **Paper colour:** There is no clear evidence that the use of particular colours of paper has any effect on responses to self-administered questionnaires. However, dark papers should be avoided as they are difficult to read. Plain white paper was used for the production of the questionnaires.
- **Thank You:** The literature stresses the importance of a printed 'Thank you' at the end of the questionnaire.

Appendix 4.a shows the questionnaire in the format used during the test of the research instrument.

4.4 QUESTIONNAIRE ADMINISTRATION AND MONITORING

Fowler (2002) argues that the most important difference between good and poor mail surveys is the extent to which researchers make repeated contact with non-respondents. Based on Dillman (2000), Fowler (2002) and Creswell (19994), a six-week questionnaire administration period was proposed for the main data collection with the issuing of three survey packs as follows:

- **Survey pack 1: Initial contact.** This package contains a cover letter, a copy of the questionnaire and a postage-paid self addressed envelope. The literature stresses the importance of a cover letter as it can affect whether or not respondents complete the questionnaire. Therefore, a cover letter will be used to persuade respondents by briefly describing why the study is being done. Further, it is a requirement of RMIT University research ethics compliance to provide all study participants with a Plain Language Statement (PLS) briefly explaining the research to participants. Whilst a prompt response will be encouraged, no deadline will be given in the first survey pack. This package will be sent to all potential respondents of the sample.
- **Survey pack 2: Follow up.** This package will be sent 7 days after the initial contact. It contains a follow up letter, an extra copy of the questionnaire and a new postage-paid self addressed envelope. The cover letter will make reference to the first survey pack and will further encourage the respondent to answer. Based on the monitoring system as discussed below, this package will be sent only to non-respondents to date.
- **Survey pack 3: Final contact.** This package contains a final persuasion letter, an extra copy of the questionnaire and a new postage-paid, self addressed envelope. The letter will stress once more the importance of the research and will now include a deadline. This package will be sent to respondents yet to answer as indicated by the monitoring system, below.

As suggested by Babbie (1990) the returned questionnaires will be monitored using a return rate graph. This graph monitors the questionnaires received against time. The subsequent implementation and analysis of this chart during the test (Chapter 5) provided a valuable indication on the best time to send reminders to participant. During the testing period this chart was updated daily. For the main survey (Chapter 7) the chart was updated weekly as it served a different purpose.

4.5 ANALYSIS OF DATA

4.5.1 Statistics overview

This research relies on statistics to analyse the data collected by the survey. Following is a review of the descriptive statistics used in this study as per Vaus (1995).

Frequency distribution tables are extensively used for data analysis in this research. Since each question (variable) is expected to have at least two answers, this type of table shows how the sample is spread, or distributed, across the various categories of each variable. Given that the categories of ordinal variables can be ranked, they will be put in their correct rank order in the frequency table where applicable. In most cases, the frequency tables have a cumulative percentage column. The cumulative percentage is a rolling addition of each of the percentages in the earlier categories of the variable. The cumulative percentage is related with the median (further explained).

The skewness of data provides useful information for analysis. This parameter can indicate not only if responses are skewed, but in what direction. The categories of ordinal data and interval variables have a natural order ranging from low to high. The variable is said to be positively skewed when responses are clustered towards the high end. The distribution would be negatively skewed when the opposite occurs. Where a distribution has a balanced appearance, it is said to be symmetrical.

Central tendency measures try to pinpoint the typicality of responses to a question. Measures of central tendency describe a group in terms of what is typical. Since not everyone in a group is typical, it is important to know how much people in the group differ from what is typical. Measures of dispersion provide this information and thus, are an indicator of how well the measure of central tendency sums up the distribution. There are different measures of central tendency and dispersion.

With nominal variables the only way to identify the typical response is to pick out the single most common response called the mode. However, there are problems with using the mode to measure typicality. First, identifying the most common response is not an indicator of how typical it is. Nonetheless, this can be calculated by the variation ratio (described below). Second, some distributions have more than one mode so it is impossible to use one figure to summarise these bimodal or multimodal distributions. Third, the mode is very vulnerable to how the categories of a variable have been collapsed. An unstable or manipulative mode can be obtained by combining people into some categories. Had these people not been combined, or combined differently, a different mode would be obtained. Nevertheless, with nominal data the mode is the best parameter.

The variation ratio is calculated by the percentage of data values not in the modal category. The higher this percentage the more poorly the mode reflects the overall distribution. The variation ratio is expressed as a proportion.

The median is preferred for ordinal data because it takes account of the fact that people can be ranked on ordinal variables. The median is calculated by ranking each case in a distribution from low to high on the variable and finding the middle value. Whatever category the middle value belongs to is the median category. Whenever there is an even number of people in a group there is no actual middle person, in this case the median will be the point between the two cases on either side of the imaginary middle person. However, the median fails to represent the group if many cases are a long way from the median category. One way to assess the summarising value of the median has been to look at the entire range of scores in a distribution. The wider the range the less adequate the median is as a descriptive statistic. The problem with using the range is that its size can be exaggerated by a few extreme cases, thus underestimating the summarising value of the median.

To avoid the distorting effect of extreme cases, the bottom 10% of cases and the top 10% can be ignored, leaving only the middle 80% called the decile range. This allows inspection of the variability of most of the sample without being overly influenced by a few extreme cases.

The mean is the most common measure of central tendency for interval variables. It is calculated by adding up the scores for each case in the sample and dividing this by the number of cases in the sample. The problem with using the mean is that it can be distorted by extreme cases and thus, it is possible to obtain the same mean for two quite different distributions. Therefore, it is necessary to know how well the mean summarises the distribution. For this, either variance or standard deviation can be used.

The logic of calculating the standard deviation is to see how ‘*far*’ each case is from the mean, then add up all these ‘*deviations*’ and obtain an overall average of these deviations to use as the measure of dispersion. Since variance is not easily interpretable, the standard deviation needs to be calculated. The lower the standard deviation, the better the mean is as a summary measure.

4.5.2 Bivariate analysis

The objective of bivariate analysis is to see whether two variables are related. Two variables are said to be associated (or related) when the distribution of values for one variable differs for different values of the other; otherwise the two variables are independent of one another. If two variables are associated predictions (inferences) can be made on the basis of limited information (Vaus 1995).

A correlation co-efficient is an index which provides a concise description of the character of the relationship between two variables. The co-efficient will always be between 0 and 1. Zero means no association and one means perfect association. Thus, the higher the figure, the stronger the association. In the case of ordinal and interval data, the co-efficient can have a minus or positive sign indicating a negative or positive association. A positive relationship means that respondents who provided a high score on one variable tended to obtain a high score on the other variable as well. A negative relationship means that those who obtained a high score on one variable tended to obtain a low score on the other (inverse). Nevertheless, the sign says nothing about the strength of the relationship (Babbie 1990, Vaus 1995).

Not all correlations are relevant. As per Vaus (1995), variables can be related but not causally related. These types of relationships are called spurious (false relationship). Based on the questions proposed on the Table 4.7 above, a matrix shown in Figure 4.8 was used to identify the type of relationship between all questions. This matrix is composed by the question ID (number) in the first column and first row. Even though there are 34 questions, there are 59 inputs that could be correlated (refer to questionnaire sample in Appendix 4a). Thus, the matrix has over three thousand cells, but only half of them are unique relationships because there is a mirror image created along the axis (black background) where the same questions intersect. The colour of each cell indicates the type of relationship at the intersection between the two questions. There are four types of relationship:

1. **Index:** A red cell indicates that the two questions belong to the same index. An ‘E’ ‘S’, ‘T’, ‘Oc’ or ‘A’ indicates the index of the relationship: Environment, Technology, Organisation Context or AWW, respectively.
2. **Logic relationship:** An orange cell indicates that there is an expected logic relationship between the two variables.
3. **Relationship between the variables:** A dark yellow cell, with an ‘r’ in it, indicates it is a relation that will be monitored by the study.
4. **Relationship outside the scope of the study:** A pale yellow cell denotes that it is a spurious relationships or a potential valid relationship but outside the scope of the study.

As previously mentioned, question 12 is a contingency question only and it is not monitored. Hence the gray cross.

The two zoomed areas graphically indicate each of the above described relationships.

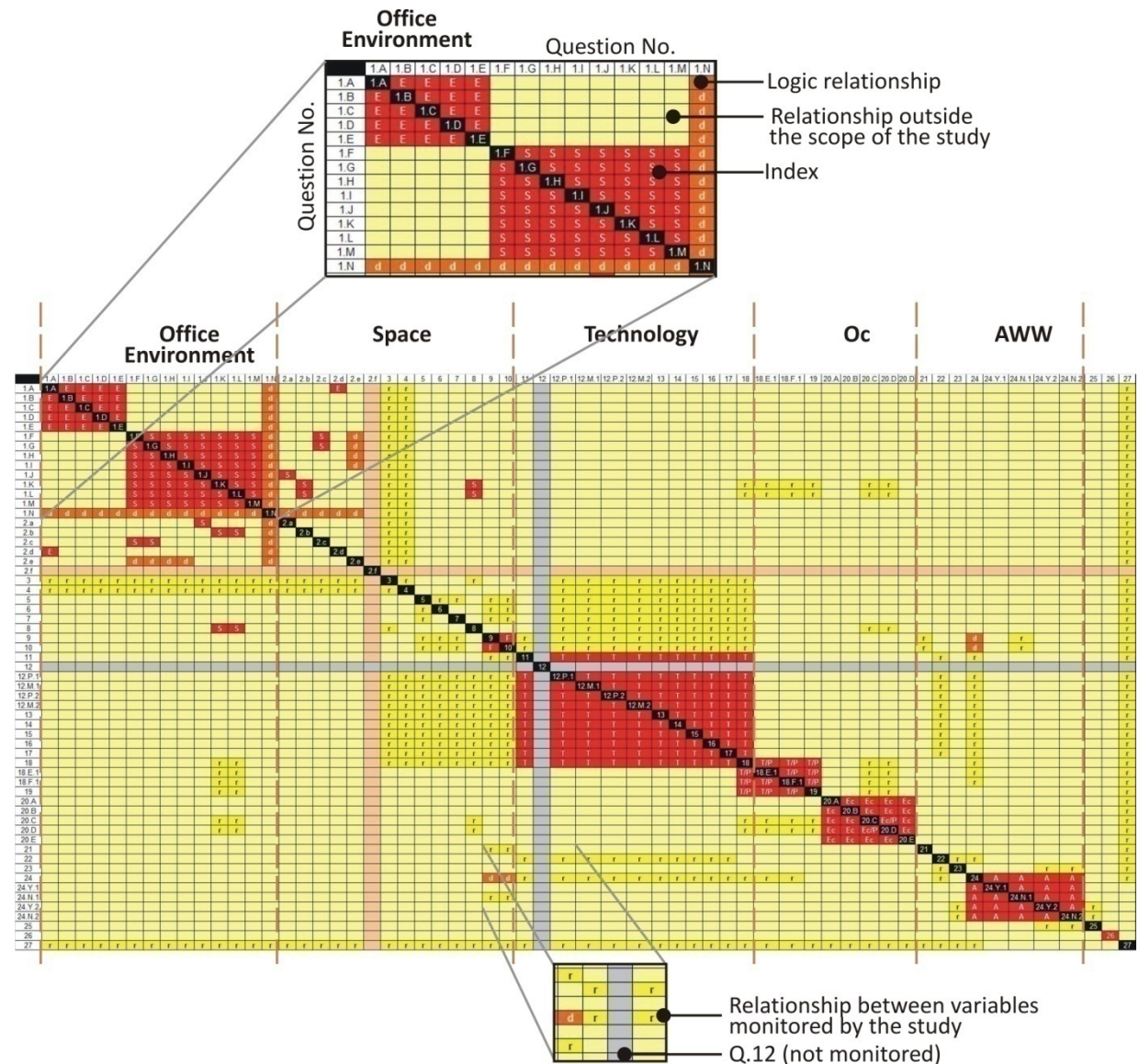


Figure 4.8. Relationship matrix.

Figure 4.9 shows the cross-group analyses proposed for the study. The analysis starts by producing individual questionnaire reports, followed by a sub-group analysis by city/suburb and by group A/B. Finally data from across the whole study is analysed.

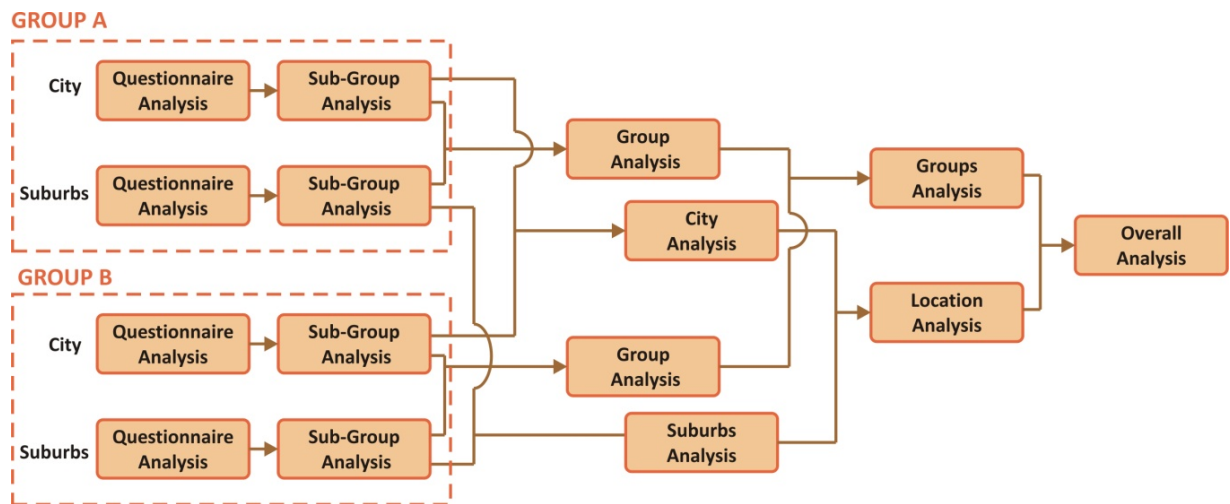


Figure 4.9. Cross-group analysis.

Whilst the above figure shows the logical path of analysis, from the single questionnaire to the overall study analysis, the actual implantation of the analysis is done in reverse. As further shown in Chapter 7, overall data (of each question) is actually analysed first and then it is grouped (in the reverse order than the above) to identify differences between groups.

4.6 SUMMARY

This chapter detailed the process of defining the content (questions), format, administration and analysis guidelines of the preliminary research instrument. The proposed questionnaire is tested in the following chapter.

This chapter is complemented by Chapter 6, where the results of testing the research approach here developed are taken into consideration to develop the final research instrument and approach.

TEST OF THE RESEARCH INSTRUMENT

CHAPTER

5

5.1 INTRODUCTION

In order to avoid the risk of the research instrument not meeting its objectives due to unforeseen errors in the design, questioning, mailing processes, and other critical procedures, a test was developed and implemented to ensure the collection, administration and analysis of reliable and valid data for the study.

This chapter comprises five sections. The first section discusses the differences between a pre-test and a pilot test and the specific characteristics of the hybrid test developed for this study. The second section documents the implementation and results of the test, including the feedback from participants. The third section details the reliability of the questionnaire. The fourth section presents the report proposed to present the result. Finally, the results of the test are discussed in the last section. The subsequent actions taken to improve the collection, administration and analysis of empirical data are discussed in Chapter 6.

5.2 DESIGN OF THE TESTING METHOD

Babbie (1990) distinguishes two different, yet complementary ways, of testing the research instrument: pre-test and pilot study. In the case of the pre-test the testing is preliminary and interactive. On the other hand, the pilot study is a miniaturised walkthrough of the entire study from sampling to reporting. Thus, the pilot test differs from the final survey only in scale. As a consequence, the pilot is directed at a representative sample of the target population selected in exactly the same fashion as for the final survey.

However, it was considered that applying both procedures could significantly delay the final data collection process. Also, the sampling process required by the pilot presented additional problems as further discussed in Chapter 6. Thus, a hybrid test was developed taking the advantages of each test and was applied to the overall process from the production of the survey kits to the reporting.

Production processes of the survey kit were tested together with the mailing and receiving of packages. Administrative staff at the university was briefed on the research and told what to do with incoming mail. One key aspect of the test was to establish a return rate. Thus no time limit was preset for the test. Instead, a detailed return rate chart was updated daily as shown in Figure 5.1 (following section).

The option '*Other*' was included in some question to allow for unforeseen answers as previously mentioned in Chapter 4 and in the table above. However, this option is removed from the final instrument to standardise the analysis of responses (see section 4.2 *Research instrument design guidelines*).

Whilst an analysis method was developed to ensure that the instrument performs in the way it was intended to, no actual analysis of the data was done because the sample does not reflect the characteristics of the study. Nevertheless, a detailed reliability analysis was done using the collected data, refer to section 5.4 *Reliability of the research instrument*.

Table 5.1 shows in the first two columns the characteristics of the Pre-test and Pilot as described by the literature (Converse and Presser 1986; Vaus 1995; Babbie 2002), the third column shows the test developed for this study.

Table 5.1. Pre-test vs. pilot test (Converse and Presser 1986; Vaus 1995; Babbie 2002) and developed test

| | Pre-test | Pilot test | Developed Test |
|---------------------------------------|--|--|--|
| Stage objectives | Preliminary research instrument, testing: <ul style="list-style-type: none"> • Question testing; • Mailing procedures; • Develop a process for data-processing; and • Develop a test analysis method. | Miniaturised version of actual survey, testing: <ul style="list-style-type: none"> • Test of all processes. Including production, mailing and administration of instrument; • Monitoring; • Data processing; • Data analysis; and • Reporting. | Combination of Pre-test and Pilot: <ul style="list-style-type: none"> • Test of production, mailing and administration of survey packages; • Question testing; • Monitoring return rate; • Data processing; • Preliminary analysis method; • Reporting. |
| Stage type | Declared (respondents are aware it is a test) | Undeclared (respondents are unaware it is a test) | Declared (respondents are aware it is a test) |
| Administration format | Self-administered / assisted | Self-Administered | Self-Administered |
| Administration timeframe | 1 week | 6 weeks | Timeframe part of the test |
| Survey packages | Preliminary (no Follow-ups) | Final package (inc. Follow-ups) | Preliminary (no Follow-ups) Refer to Appendix 4a |
| Number of questions | Larger than the pilot test. More questions are tested than the ones expected to reach the pilot test and final survey. | No questions are tested at this stage. Same questions as the final survey. | All questions to be tested, but no more than the required. |
| “Other” included as an option. | Yes. | As applicable | As applicable |
| Sampling | No | Yes | Convenience sampling |
| Data analysis | No | Yes | Only to test reliability |

Since respondents were told that the instrument was being tested, the procedure benefitted from the flexibility of being a declared test and participants were requested to provide comments on the questionnaire. For this, an assessment form was included in the test kit where respondents commented on specific aspects of the research instrument. The content of the test kit was as per the following list (refer to Appendix 4a for a sample of the Test Kit):

- **Cover letter:** One page letter explaining the research to participants and what was required from them;
- **Questionnaire:** A copy of the proposed research instrument as designed in the previous chapter;

- **Assessment form:** A form for participants to assess and comment on the proposed questionnaire. Participants were asked to evaluate the questionnaire on various criteria including completion time, difficulty of questions and overall design. This is further explained in the next section; and
- **Return envelope:** A pre-paid, self-addressed envelope for participants to return the completed survey and assessment form.

5.3 TEST OF THE RESEARCH INSTRUMENT

This section documents the results of testing of the research instrument.

The Test Kit was sent to 31 participants on Monday 14th of August 2006. The package was sent to four companies (Groups A, B, C, and D). Groups A and B were from Melbourne suburbs: Hawthorn (Post Code 3122) and Collingwood (3066), respectively. Groups C and D were from Melbourne CBD (3001 and 3004). Three test kits were sent to just one person from three different companies, identified as 'Individual' and with IDs PT-04 to PT-06. Table 5.2 shows the list of questionnaires sent and the date they were returned.

Table 5.2. List of test participants

| Group | ID | Returned date | Group | ID | Returned date |
|------------------------------------|----------|---------------|-----------------------------------|----------|---------------|
| Group A 80% Returned | PT-01-01 | 25-Aug-06 | Group D 57% Returned | PT-07-01 | *** |
| | PT-01-02 | 01-Sep-06 | | PT-07-02 | 28-Aug-06 |
| | PT-01-03 | *** | | PT-07-03 | 10-Oct-06 |
| | PT-01-04 | *** | | PT-07-04 | 29-Aug-06 |
| | PT-01-05 | 18-Aug-06 | | PT-07-05 | *** |
| | PT-01-06 | 15-Aug-06 | | PT-07-06 | 15-Aug-06 |
| | PT-01-07 | 22-Sep-06 | | PT-07-07 | *** |
| | PT-01-08 | 01-Sep-06 | Individual | PT-04-01 | *** |
| | PT-01-09 | 15-Aug-06 | | PT-05-01 | 13-Sep-06 |
| | PT-01-10 | 15-Aug-06 | | PT-06-01 | 15-Aug-06 |
| Group B 100% Returned | PT-02-01 | 16-Aug-06 | | | |
| | PT-02-02 | 17-Aug-06 | | | |
| | PT-02-03 | 16-Aug-06 | | | |
| Group C 63% Returned | PT-03-01 | 01-Sep-06 | | | |
| | PT-03-02 | *** | | | |
| | PT-03-03 | 06-Oct-06 | | | |
| | PT-03-04 | 25-Aug-06 | | | |
| | PT-03-05 | 18-Aug-06 | | | |
| | PT-03-06 | *** | | | |
| | PT-03-07 | 18-Aug-06 | | | |
| | PT-03-08 | *** | | | |

As previously mentioned, one of the parameters tested was the return rate of the questionnaires. Therefore, no pre-established limit of time was set for the recollection of surveys. The last column of the above table shows the return date. Non-respondents are labelled "***". The last returned questionnaire arrived on Week 9 (Friday 13th of October 2006). By the end of such week, a total of 22 questionnaires were received, which represent a success rate of 71%. Table 5.3 summarises the number of questionnaires received per week.

Table 5.3. Returned questionnaires per week

| Week No | Returned per week | % | % Accum |
|--------------|-------------------|-------------|---------|
| 1 | 11 | 50.0% | 50.0% |
| 2 | 2 | 9.1% | 59.1% |
| 3 | 5 | 22.7% | 81.8% |
| 4 | 0 | 0.0% | 81.8% |
| 5 | 1 | 4.5% | 86.4% |
| 6 | 1 | 4.5% | 90.9% |
| 7 | 0 | 0.0% | 90.9% |
| 8 | 1 | 4.5% | 95.5% |
| 9 | 1 | 4.5% | 100.0% |
| Total | 22 | 100% | |

It is important to note that Week 1 had the highest number of returned questionnaires per week and that by Week 3, 81% of all returned were received. Whilst no questionnaires were received during Week 4 and 7, there were no two consecutive weeks without receiving questionnaires.

Figure 5.1 shows the daily return graph. The lower line shows the number of questionnaires received per day. The higher line shows the accumulated number of returned questionnaires.

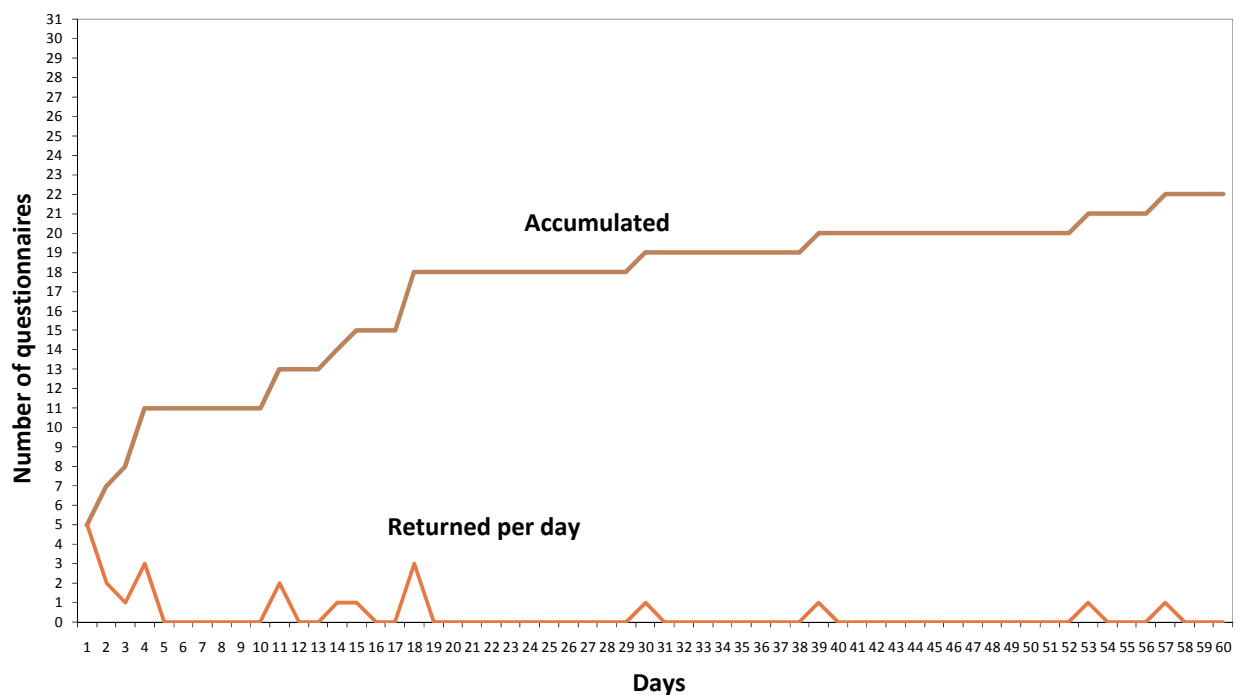


Figure 5.1. Test questionnaires return graph (Day 1 to 60)

The highest number of returned questionnaires, 5, was received surprisingly the next day the questionnaires were sent, labelled day one in the above chart. The next peak occurred on day 4 and 18 (week 3), both registering 3 questionnaires per day.

5.3.1 Feedback

Overall, the feedback reported on the assessment form was very positive. However, some issues were identified. Following are the results.

Feedback Question 1: ‘Approximate time to complete the questionnaire’: As shown on Figure 5.2 the majority (68%) of the respondent completed the questionnaire in 10 minutes or less. The fastest time (registered only by one person) was 2 minutes, which means he averaged 2.4 seconds per question including reading time. On the other extreme, four people required 20 minutes to complete the questionnaire, which averages 24 seconds per question. Both extremes suggest that the registered time was estimated rather than recorded. Further comments are made on Question 10.

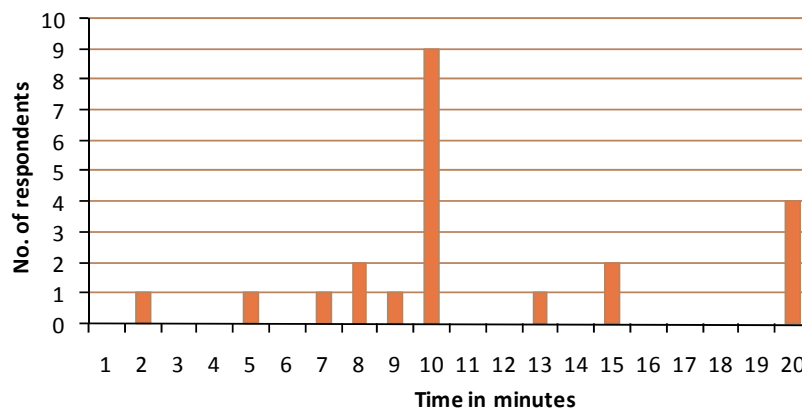


Figure 5.2. Time to complete test questionnaire.

The average (most typical) completion time of 10 minutes is considered acceptable and as further discussed under Question 10, most people did not feel that the questionnaire was too long. Therefore, the questionnaire was not modified to reduce the completion time.

Feedback Question 2: ‘Do you find the questionnaire easy to answer?’: Almost all of the respondents (20, 91%) considered the questionnaire easy to answer. With the exception of a few questions, especially within the technology index (see Question 8 and comments on Question 11) the questionnaire was considered easy to answer.

Feedback Question 3: ‘Do you find the questionnaire confusing?’: Most of respondents (19, 86%) did not find the questionnaire confusing. However (2, 9%) thought otherwise. One person did not answer this question. This result is similar to Question 5, which could suggest a relationship between a confusing questionnaire and a cluttered one. Moreover, this result might also reflect the complexity of some questions, especially those within the technology index.

Feedback Question 4: ‘Do questions seem to fit together?’: All respondents (22, 100%) agree that questions seem to fit together. Thus, a similar flow is used in the final questionnaire.

Feedback Question 5: ‘Do you find the questionnaire cluttered?’: Since this is a factor considered to reduce response rate, it is considered a positive outcome that almost all respondents (20, 91%) found the questionnaire uncluttered. Pages 3 and 5 of the test questionnaire were the most cluttered ones. However, one respondent made a positive

comment on the flow of contingency questions on page 5 of the questionnaire (refer to Question 11, respondent PT-03-05).

Feedback Question 6: ‘Do you like the overall design of the questionnaire?’: Almost all respondents (21, 95%) respondents liked the design of the questionnaire. Thus, the design is considered to be appropriate. However, some changes were done to the final questionnaire to improve its design.

Feedback Question 7: ‘Do you find the questionnaire interesting?’: The majority of respondents (18, 81%) considered the questionnaire interesting. One person did not answer the question. As previously mentioned in Chapter 4, difficult questions or questions that the respondent might not know the answer to, can reduce the interest on the questionnaire with the potential risk of not completing it, this was observed on respondent PT-03-04, refer to Question 11.

Feedback Question 8: ‘Which questions do you find difficult to answer?’: Questions that respondents find difficult to answer can affect the reliability of the data recollected by them. Following is a list of the most critical questions in order of number of respondents that considered them difficult to answer.

- **Considered difficult by 6 respondents (the highest):**
 - **Q12.P.1** Which is your computer’s microprocessor (CPU)?
- **Considered difficult by 4 respondents:**
 - **Q12.P.2** Which software and version of word processor is used at your workplace?
 - **Q24.N.2** Which do you think would be the most common pros and cons of adopting alternative ways of working.
- **Considered difficult by 3 respondents:**
 - **Q2.** From the following list rank the deficiencies that apply to your workplace.
 - **Q13.** Does your workplace have Internet connection?
 - **Q17.** Which scenario best describes the adoption process of new technology in your workplace?
 - **Q24.Y.2** Which pros and cons have you experienced as a consequence of adopting alternative ways of working.
 - **Q27.** How many people work at your company?
- **Considered difficult by 2 respondents:**
 - **Q6.** How many meeting rooms are at your workplace?
 - **Q8.** Has any space been adapted to allow for more storage space?
 - **Q12.M.1** What model is your computer?
- **Considered difficult by 1 respondent:**
 - a total of 10 questions (Questions 4, 5, 9, 12.M.2, 18, 20, 23, 24.Y.1, 24.N.1 and 26) were considered difficult by one respondent (not the same in all the case).

It is considered that the low number of responses to this question (12, 55%), is not due to the fact that non-respondents did not find some of the questions difficult to answer, but because of the process of answering this question (going through the questionnaire once again, back and forth to identify and circle the questions) might have tested the patience of some already tired respondents.

Feedback Question 9: ‘Which questions do you feel to say more?’: Following is a list (in order) of the questions which respondents felt they wanted to say more:

- **Selected by 6 respondents (the highest):**
 - **Q.6:** *How many meeting rooms are at your workplace?*
- **Selected by 4 respondents:**
 - **Q.23:** *On average, how many hours do you work overtime on a fortnightly basis?*
- **Selected by 3 respondents:**
 - **Q.21:** *Rank the level of bureaucracy at your workplace.*
 - **Q.22:** *Rank the level of competition at your workplace.*
- **Selected by 2 respondents:**
 - **Q.1:** *Evaluate the following parameters at your workplace: A) Temperature, B) Ventilation Comfort,... N) Overall satisfaction of the space environment at your workplace.*
 - **Q.2:** *From the following list rank the deficiencies that apply to your workplace: Shortage of space (in general), etc.*
 - **Q.3:** *In what type of building is your office located?*
 - **Q.8** *Has any space been adapted to allow for more storage space?*
 - **Q.9** *How flexible is your workplace about when employees do their work?*
 - **Q.17** *Which scenario best describes the adoption process of new technology in your workplace?*
 - **Q.18** *Does your workplace rely more on faxes or e-mails to receive and send information?*
 - **Q.19** *Are hardcopy documents scanned?*
 - **Q.20** *Are there policies in your workplace to reduce the use of: A) Electricity, B) Water, etc.*
 - **Q.24.N.2** *Which do you think would be the most common pros and cons of adopting alternative ways of working?*
- **Selected by 1 respondent:**
 - In a total of 12 questions (Questions: 4, 5, 10, 11, 12.P.1, 12.M.1, 18.E.1, 24.Y.1, 24.N.1, 25, 26, 27) one participant (not the same in all cases) wanted to say more.

This question registered a higher number of non-respondents (15, 68%) than Feedback Question 8. Again, the reason behind the low participation might be as previously discussed under Question 8.

Feedback Question 10: ‘Do you feel that the questionnaire is too long?’: Whilst Feedback Question 1 aimed to measure the objective completion time, this question measured the respondents’ perception of how long the questionnaire felt. Almost all respondents (20, 92%) did not feel the questionnaire was too long. A cross-analysis with Feedback Question 1 showed that the two respondents that thought otherwise took 8 and 20 minutes to complete it. This seems to suggest that other factors like difficulty and interest on the topic, might influence the perception of how long the questionnaire seems, rather than just completion time in itself.

Feedback Question 11: ‘How would you improve the questionnaire?’: This open ended question was answered by 11 participants. Table 5.4 summarises the comments provided. The most common comments were to improve the wording of the questions and to add more space for personal input (e.g. ‘Other’ field).

Table 5.4. Suggestions to improve the questionnaire

| ID | Comment |
|----------|--|
| PT-01-05 | I wouldn't. The questionnaire is precise and the pathways are logical. |
| PT-01-09 | Simple layout – but overall good job!!! |
| PT-02-01 | Perhaps more probing questions to policies of energy efficiency and awareness of healthy work practices (i.e. Time spent in front of computer without a break) Importance of social interaction at work conversation, etc. |
| PT-02-02 | More spaces for personal input (i.e. Other answers) |
| PT-03-01 | With some space for comments and discussion at the end. Perhaps – few open questions, i.e. Like this one. |
| PT-03-03 | Need scope for answers from casual employees (i.e. Not fulltime or part time, but a few hours each week) |
| PT-03-04 | Most difficulty through not knowing the answers – Not my interest. Will most employees know the technical details of the IT facilities? Comment on cover letter: very transparent. Try something like: <i>“your reply counts for those we cannot contact.”</i> |
| PT-03-05 | Some wording confusing. I thought the flow arrows on P5 were good! |
| PT-06-01 | Some of the wording of questions could be improved. |
| PT-07-04 | Question 24 confusing. Separate alternative questions as appropriate. |
| PT-07-06 | No changes |

Comments are discussed and taken into consideration in the following chapter.

5.4 RELIABILITY OF THE RESEARCH INSTRUMENT

In this section the data of the test are interpreted and analysed to test the reliability of the research instrument and to assess the suitability of the research paradigm. Table 5.5 shows the results of the test by group, each group represents a company, refer to Table 5.2 above. Individual questionnaires were not used for the reliability test.

The column on the left (1.A, 1.B, etc.) shows the IDs of the questions selected for the reliability analysis. These questions are classified into subjective (questions 1.A to 1.N, 7 and 22) or objective questions (questions 3 to 6, 9 to 11 and 14 to 22). The former refers to assessments of subjective environmental characteristics like temperature, ventilation, illumination, etc. On the other hand, the latter provides information about objective attributes of the respondent workplace like type of building, Internet connection type and so on, refer to Appendix 4a. The following four columns of Table 5.5 (merged over five sub-columns) show how many respondents provided a specific response by group (frequency table). The next set of four columns is the score assigned to each question by group. This score is an indicator of how homogenous is the response. A perfectly homogenous question, that in which all respondents provided the same answer, scores '4'. A completely heterogeneous question, that in which there is no consensus between answers, scores '0'. The scores were calculated using descriptive statistics indicators such as standard error, standard deviation, sample variance, skewness and range, refer to Appendix 5a. The last two columns show the reliability score, which is the average of the group scores in the four preceding columns.

Table 5.5. Reliability assessment of the research instrument

| | | FREQUENCY TABLE | | | | | | | | | | | | | | | | | | | | SCORE BY GROUP | | | | SUBJECTIVE | OBJECTIVE |
|-----------------------|------|-----------------|---|---|---|-----|-----------------|---|---|---|-----|-----------------|---|---|---|-----|-----------------|---|---|---|-----|----------------|-------|-------|-------|------------|-----------|
| | | GROUP A Count 8 | | | | | GROUP B Count 3 | | | | | GROUP C Count 5 | | | | | GROUP D Count 4 | | | | | GRP A | GRP B | GRP C | GRP D | | |
| | | 1 | 2 | 3 | 4 | 5-9 | 1 | 2 | 3 | 4 | 5-9 | 1 | 2 | 3 | 4 | 5-9 | 1 | 2 | 3 | 4 | 5-9 | | | | | | |
| SUBJECTIVE PERCEPTION | 1.A | - | - | 3 | 5 | | 1 | - | 2 | - | | 1 | 1 | 3 | - | | - | 2 | 2 | - | | 2 | 2 | 2 | 2 | 2 | |
| | 1.B | - | 1 | 5 | 2 | | - | 3 | - | - | | 2 | 2 | - | 1 | | - | 3 | - | 1 | | 1 | 4 | 1 | 2 | 2 | |
| | 1.C | - | 1 | 5 | 2 | | - | 2 | 1 | - | | 3 | 1 | 1 | - | | 1 | 2 | - | 1 | | 1 | 3 | 2 | 1 | 1.75 | |
| | 1.D | - | - | 1 | 7 | | 1 | - | 1 | 1 | | 2 | 2 | 1 | - | | 1 | 1 | 1 | 1 | | 3 | 0 | 1 | 0 | 1 | |
| | 1.E | - | 1 | 5 | 2 | | 1 | - | 2 | - | | 1 | 1 | 3 | - | | 1 | 1 | 2 | - | | 1 | 2 | 2 | 1 | 1.5 | |
| | 1.F | 1 | 2 | 3 | 2 | | 2 | - | 1 | - | | 2 | - | 1 | 2 | | - | 2 | 2 | - | | 0 | 2 | 0 | 2 | 1 | |
| | 1.G | 3 | 5 | - | - | | 2 | 1 | - | - | | 2 | - | 2 | 1 | | - | 2 | 2 | - | | 2 | 3 | 0 | 2 | 1.75 | |
| | 1.H | - | - | 7 | 1 | | - | - | 3 | - | | - | 1 | 3 | 1 | | 1 | - | 2 | 1 | | 3 | 4 | 3 | 1 | 2.75 | |
| | 1.I | - | - | 7 | 1 | | 1 | - | 2 | - | | 2 | 1 | 2 | - | | 1 | 1 | 2 | - | | 3 | 2 | 0 | 1 | 1.5 | |
| | 1.J | - | - | 1 | 7 | | - | 1 | - | 2 | | 3 | - | 2 | - | | 1 | 1 | 2 | - | | 3 | 2 | 1 | 1 | 1.75 | |
| | 1.K | 1 | 2 | 3 | 2 | | 1 | 1 | - | 1 | | 2 | 1 | 1 | 1 | | 3 | 1 | - | - | | 0 | 0 | 0 | 3 | 0.75 | |
| | 1.L | - | 2 | 4 | 2 | | - | - | 3 | - | | 2 | 1 | - | 2 | | 2 | 1 | 1 | - | | 1 | 4 | 0 | 1 | 1.5 | |
| | 1.M | - | 2 | 2 | 4 | | 1 | - | 1 | 1 | | 1 | - | 1 | 3 | | 1 | 3 | - | - | | 1 | 0 | 1 | 3 | 1.25 | |
| | 1.N | - | - | 5 | 3 | | - | 1 | 1 | 1 | | 3 | - | 2 | - | | 1 | 3 | - | - | | 2 | 0 | 0 | 3 | 1.25 | |
| OBJTV. | 3 | - | 5 | 3 | | | - | 3 | - | - | | - | - | 5 | - | | 4 | - | - | - | | 2 | 4 | 4 | 4 | | 3.5 |
| | 4 | - | 8 | | | | - | 3 | | | | 3 | 1 | | | | 3 | 1 | | | | 4 | 4 | 2 | 2 | | 3 |
| | 5 | 2 | 5 | 1 | | | 3 | - | - | - | | 2 | 3 | - | - | | 4 | - | - | - | | 1 | 4 | 3 | 4 | | 3 |
| | 6 | - | 7 | - | 1 | - | - | 2 | 1 | - | - | 1 | 1 | 2 | - | - | - | 4 | - | - | - | 3 | 3 | 1 | 4 | | 2.75 |
| S | 7 | 1 | 7 | - | - | | - | 3 | - | - | | 4 | 1 | - | - | | 1 | 3 | - | - | | 3 | 4 | 3 | 3 | 3.25 | |
| | 9 | 1 | 3 | 1 | 3 | | 1 | 2 | - | - | | - | - | 1 | 4 | | 3 | 1 | - | - | | 0 | 3 | 3 | 3 | | 2.25 |
| | 10 | 3 | 3 | 1 | 1 | | 2 | 1 | - | - | | - | - | 3 | 2 | | 4 | - | - | - | | 0 | 3 | 2 | 4 | | 2.25 |
| | 11 | 8 | - | | | | 3 | - | | | | 5 | - | | | | 4 | - | | | | 4 | 4 | 4 | 4 | | 4 |
| | 14 | 8 | - | | | | 2 | 1 | | | | 5 | - | | | | 2 | 2 | | | | 4 | 1 | 4 | 0 | | 2.25 |
| | 15 | - | 8 | | | | 1 | 2 | | | | 4 | 1 | | | | - | 4 | | | | 4 | 1 | 2 | 4 | | 2.75 |
| | 16 | 1 | - | 4 | 3 | | - | - | 3 | - | | 1 | 2 | 2 | - | | - | 3 | 1 | - | | 0 | 4 | 1 | 3 | | 2 |
| | 17 | - | 2 | 6 | - | | - | 2 | 1 | - | | - | 2 | 3 | - | | 2 | 2 | - | - | | 3 | 3 | 2 | 2 | | 2.5 |
| | 18 | 7 | - | | | | 2 | 1 | | | | 5 | - | | | | 3 | 1 | | | | 4 | | 4 | 3 | | 2.75 |
| | 19 | 3 | 5 | | | | 2 | 1 | | | | 2 | 3 | | | | - | 4 | | | | 1 | 1 | 0 | 4 | | 1.5 |
| | 20.A | - | 3 | 5 | | | - | - | 3 | | | 1 | - | 3 | | | - | 1 | 3 | | | 2 | 4 | 1 | 3 | | 2.5 |
| | 20.B | 1 | 2 | 5 | | | - | - | 3 | | | 1 | - | 3 | | | - | 1 | 3 | | | 1 | 4 | 1 | 3 | | 2.25 |
| | 20.C | 3 | 5 | - | | | 1 | 1 | 1 | | | 1 | 1 | 2 | | | - | 3 | 1 | | | 2 | 0 | 1 | 3 | | 1.5 |
| | 20.D | - | 3 | 5 | | | - | 1 | 2 | | | 1 | 1 | 2 | | | - | 1 | 3 | | | 2 | 3 | 1 | 3 | | 2.25 |
| | 20.E | - | 1 | 7 | | | - | - | 3 | | | 2 | - | 2 | | | - | 1 | 3 | | | 3 | 4 | 0 | 3 | | 2.5 |
| | 21 | - | 6 | 2 | - | | - | 3 | - | - | | - | 2 | 2 | 1 | | - | - | - | 4 | | 3 | 4 | 1 | 4 | | 3 |
| | 22 | 3 | 3 | 1 | 1 | | - | 3 | - | - | | 1 | 2 | 2 | - | | 2 | 2 | - | - | | 0 | 4 | 1 | 2 | 1.75 | |
| | | | | | | | | | | | | | | | | | | | | | | 1.97 | 2.57 | 1.54 | 2.51 | | |

SCALES:

X

X

X

X

-

100%

Concentration of responses

0%

4

3

2

1

0

Refer to Appendix 5.a

3 - 4

2 - 2.9

0 - 1.9

Overall score (Average)

The average score of subjective questions is 1.67, the average score of objective questions is 2.55. As expected, objective questions are more reliable than subjective questions. However, it is interesting to note that, for example, question 19 “Does your company have a website?” is considered to be an objective parameter: either the company has a website or not independently of how the respondent feels about it. Still, groups A, B and C have mixed responses, when in fact they all have a website. Refer to Table 5.5.

However, further analysis indicates that whilst the assessment of the environment varied considerably between respondents, there is a relationship in the way such assessment is done. Figure 5.3 is a scattergram that plots the score given to question 1N: overall satisfaction of the space environment at the workplace (Y axis) vs. each of the individual factors that contribute to the overall satisfaction: temperature, ventilation, etc. (X axis). Regression lines are added for analysis.

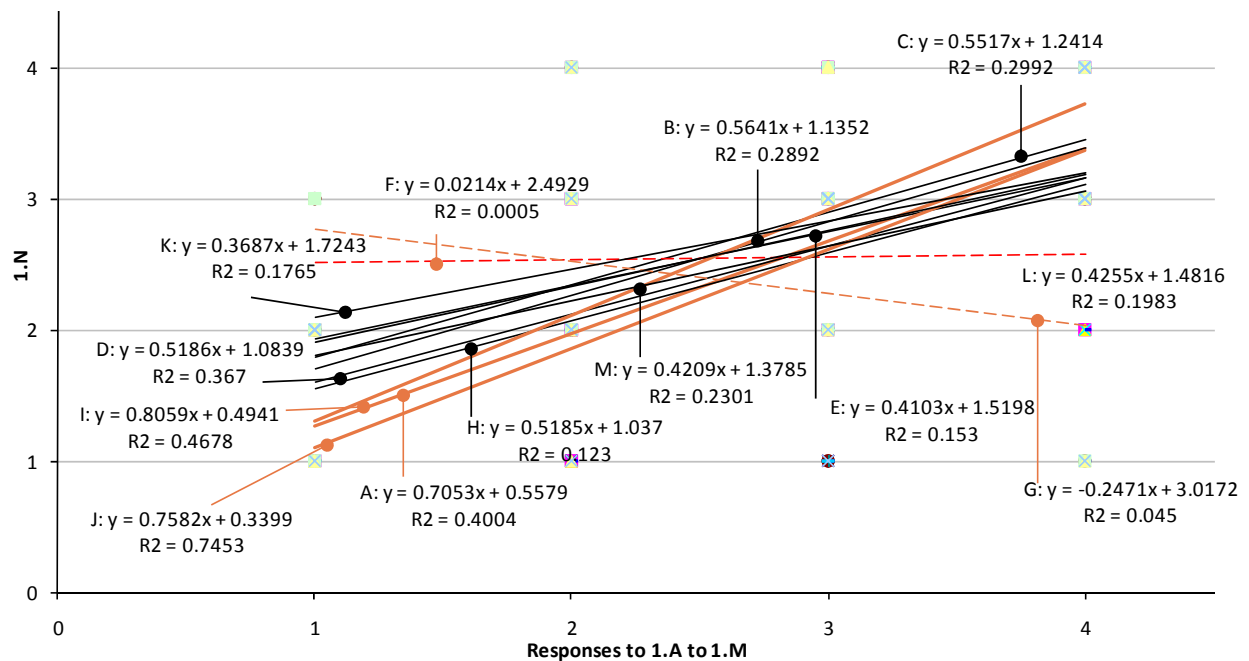









Figure 5.3. Overall satisfaction vs. individual environment parameters

The regression line predicts Y scores of individuals given knowledge of X scores and estimates the strength of association between X and Y. The impact of X on Y is given by the slope (m) of the linear equation. The higher R^2 value is, the higher the accuracy of predictability and the higher the slope (m) the higher the impact of X on Y (Vaus 1995).

Table 5.6 sorts the individual parameters by predictability accuracy and impact. It is noted that the three most predictable parameters are also the ones that have the highest impact. With the exception of 1.G and 1.F, which also score the lowest predictability and impact, the trend lines suggest a directly proportional relationship between the overall satisfaction and the individual variables. This implies that whilst there is no consensus between respondents in assessing subjective parameters there is consistency in the way the variable is assessed.

Table 5.6. Trend line analysis: Parameters sorted by R^2 and m

| | | | R2 | | | | m |
|-----|-------------------------------------|--------|---|-----|-------------------------------------|---------|---|
| 1.J | General office size | 0.7453 |  | 1.I | General furniture arrangement | 0.8059 | |
| 1.I | General furniture arrangement | 0.4678 | | 1.J | General office size | 0.7582 | |
| 1.A | Temperature comfort | 0.4004 |  | 1.A | Temperature comfort | 0.7053 | |
| 1.D | Background noise level | 0.367 |  | 1.B | Ventilation comfort | 0.5641 | |
| 1.C | Illumination comfort | 0.2992 | | 1.C | Illumination comfort | 0.5517 | |
| 1.B | Ventilation comfort | 0.2892 | | 1.D | Background noise level | 0.5186 | |
| 1.M | Work space available on workstation | 0.2301 |  | 1.H | General office distribution | 0.5185 | |
| 1.L | Individual storage space | 0.1983 | | 1.L | Individual storage space | 0.4255 | |
| 1.K | General office storage space | 0.1765 | | 1.M | Work space available on workstation | 0.4209 | |
| 1.E | Frequency of distractions | 0.153 |  | 1.E | Frequency of distractions | 0.4103 | |
| 1.H | General office distribution | 0.123 | | 1.K | General office storage space | 0.3687 | |
| 1.G | Voice privacy at your workstation | 0.045 |  | 1.G | Voice privacy at your workstation | -0.2471 | |
| 1.F | Visual privacy at your workstation | 0.0005 |  | 1.F | Visual privacy at your workstation | 0.0214 | |

This constant relationship in which the variables are assessed is further corroborated by using a correlation matrix. Refer to the *Bivariate analysis* section on Chapter 4 for interpretation of correlation indexes.

In Table 5.7, the mirror image of the correlation table generated above the diagonal where the variable intersects with itself has been substituted by the correlation of random numbers. These random numbers were generated using the same range (1-4) and the same sample size (22) of the test study. The adjacent frequency table groups the correlations in five ranges. This table shows that the test correlation index exceeds that of the random sample.

Table 5.7. Correlation matrix: Test vs. Random

| | RANDOM | | | | | | | | | | | | | | |
|-----|-------------|-------------|-------------|-------------|-------------|-------------|-------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-----|
| 1.A | 1.A | -0.11 | 0.01 | 0.28 | -0.46 | 0.00 | -0.10 | -0.26 | -0.16 | -0.24 | 0.05 | 0.09 | -0.30 | 0.31 | 1.A |
| 1.B | 0.49 | 1.B | 0.06 | 0.02 | -0.01 | -0.03 | -0.13 | 0.40 | -0.03 | -0.03 | 0.10 | -0.20 | -0.24 | -0.22 | 1.B |
| 1.C | 0.65 | 0.49 | 1.C | -0.31 | -0.11 | -0.17 | -0.21 | 0.33 | 0.08 | 0.02 | 0.07 | -0.29 | -0.02 | 0.18 | 1.C |
| 1.D | 0.55 | 0.50 | 0.34 | 1.D | -0.26 | 0.12 | 0.15 | -0.22 | 0.10 | 0.16 | -0.18 | 0.10 | -0.11 | -0.09 | 1.D |
| 1.E | 0.60 | 0.18 | 0.64 | 0.50 | 1.E | -0.02 | 0.16 | -0.07 | 0.14 | 0.01 | 0.08 | -0.25 | 0.11 | -0.30 | 1.E |
| 1.F | 0.42 | 0.36 | 0.19 | 0.32 | 0.31 | 1.F | 0.20 | -0.16 | -0.03 | -0.10 | 0.19 | -0.19 | 0.10 | 0.31 | 1.F |
| 1.G | 0.10 | 0.17 | 0.04 | 0.03 | 0.28 | 0.69 | 1.G | -0.23 | 0.10 | 0.23 | 0.15 | 0.13 | 0.34 | -0.04 | 1.G |
| 1.H | 0.36 | 0.22 | 0.33 | 0.21 | 0.51 | 0.12 | 0.07 | 1.H | 0.03 | 0.10 | -0.10 | -0.14 | -0.38 | 0.02 | 1.H |
| 1.I | 0.68 | 0.35 | 0.42 | 0.48 | 0.46 | 0.18 | -0.12 | 0.58 | 1.I | -0.33 | 0.14 | -0.32 | 0.03 | -0.12 | 1.I |
| 1.J | 0.67 | 0.52 | 0.65 | 0.58 | 0.43 | 0.07 | -0.29 | 0.35 | 0.78 | 1.J | -0.33 | 0.29 | -0.01 | -0.14 | 1.J |
| 1.K | 0.63 | 0.28 | 0.54 | 0.21 | 0.49 | 0.18 | 0.02 | 0.39 | 0.59 | 0.48 | 1.K | -0.17 | 0.15 | -0.23 | 1.K |
| 1.L | 0.60 | 0.26 | 0.63 | 0.11 | 0.44 | 0.33 | 0.10 | 0.40 | 0.37 | 0.43 | 0.76 | 1.L | 0.04 | 0.07 | 1.L |
| 1.M | 0.55 | 0.24 | 0.28 | 0.18 | 0.28 | 0.31 | 0.03 | 0.15 | 0.42 | 0.38 | 0.65 | 0.68 | 1.M | -0.12 | 1.M |
| 1.N | 0.63 | 0.54 | 0.55 | 0.61 | 0.39 | 0.02 | -0.21 | 0.35 | 0.68 | 0.86 | 0.42 | 0.45 | 0.48 | 1.N | 1.N |
| | PILOT | | | | | | | | | | | | | | |

| | RANDOM | | PILOT | |
|-----------|--------|------|-------|------|
| 0.76-1.00 | 0 | 0% | 3 | 3% |
| 0.51-0.75 | 0 | 0% | 25 | 27% |
| 0.26-0.50 | 16 | 18% | 39 | 43% |
| 0.10-0.25 | 48 | 53% | 17 | 19% |
| 0.00-0.09 | 27 | 30% | 7 | 8% |
| | 91 | 100% | 91 | 100% |

However, not all correlations are relevant as previously explained in Chapter 4. For example correlation 1.B (ventilation comfort) and 1.L (individual storage) is a spurious relationship. Non spurious relationships are bolded in the cell entries in Table 5.7.

The results from the test are compatible with the research paradigm in that they suggest that workplace environments are subjectively interpreted to construct several realities of a single environment. However, these subjective realities are not randomly created. They denote consistency and are constructed from a common reality.

The challenge of evaluating an architectural environment through the subjectivity of respondents is well acknowledged by the literature. Following is a brief discussion on the challenges identified by the literature that are encountered by researchers whilst trying to evaluate workplace architecture.

5.4.1a Evaluating workplace architecture

Back in the 1980s when office technology started to change rapidly, the issue of performance on the job and how it is affected by the physical environment was reignited. Earlier studies support the debate that the design of the workplace can affect job performance and satisfaction of workers on the job (Marans and Spreckelmeyer 1982).

Amongst the most relevant studies of environment and performance is the one undertaken at the Hawthorne Works factory. Between 1924 and 1932 Elton Mayo and Fritz Roethlisberger conducted a series of experiments to determine the optimum level of lighting

for productivity. After an increase of productivity was reported regardless whether the illumination was increased or decreased, the conclusion was that people change their behaviour when observed. Employees found out they were being monitored and kept improving their performance regardless of the changing illumination. This, as noted by Hatch (1997) seems to indicate that the effects of physical conditions (lighting) are insignificant compared with social effects (pressure of being observed).

A number of environmental researchers and designers have sought to isolate relationships between specific attributes of the workplace on the one hand, and satisfaction and performance on the other. Several have done so within the framework of empirically based post occupancy evaluations. However, Marans and Spreckelmeyer (1982) note that one of the failures of post-occupancy methods is the lack of a carefully developed conceptual link between physical environmental attributes and various levels of worker responses to those attributes.

Thus, in their conceptual model Marans and Spreckelmeyer acknowledge that an individual's perception of a particular attribute is dependent on, but distinct from, the objective environmental attribute itself. Further, the characteristics of an individual are seen as affecting his or her perceptions and assessments of environmental attributes and the standard for comparisons that are used. These two principles are not only consistent with, but fundamental for the adopted epistemology, ontology and theoretical perspective as previously discussed in Chapter 3.

Figure 5.4 shows Marans' and Spreckelmeyer's (1982) conceptual model for evaluating work environments. The model proposes direct and indirect links between objective environmental attributes, people's subjective responses to these attributes, overall environmental satisfaction, and specific behaviour or sets of behaviours.

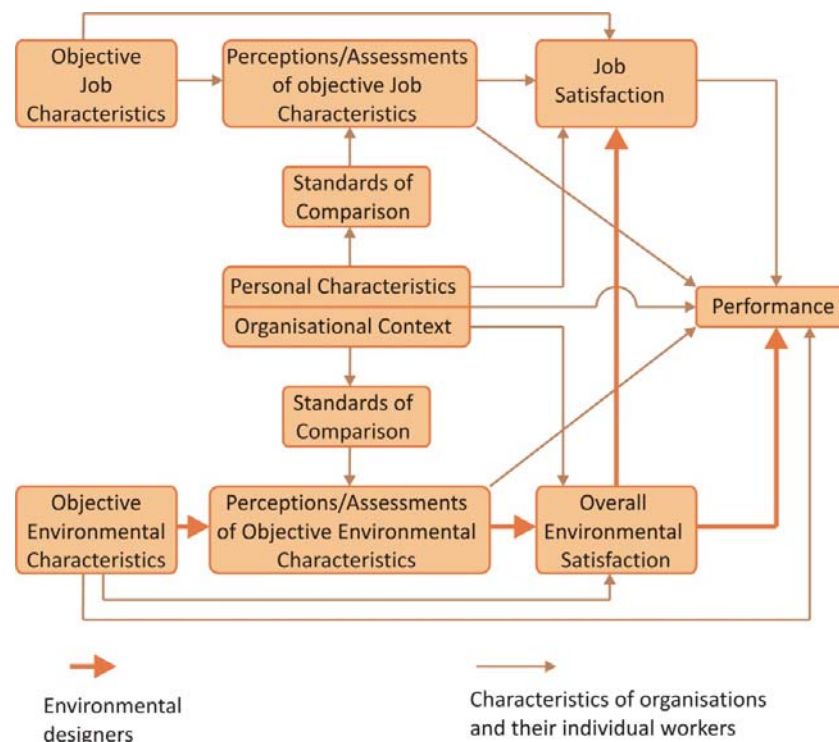


Figure 5.4. Conceptual model for evaluating work environments based on Marans and Spreckelmeyer (1982).

The above model considers three aspects:

- 1) overall environmental satisfaction;
- 2) job satisfaction; and
- 3) worker performance.

However, it is the first (overall environmental satisfaction) that is of greatest interest to architects and most relevant to this research. Overall environmental satisfaction for an employee is dependant upon four factors:

- 1) the characteristics of the employee, including his or her position or job type;
- 2) the organisational context in which employee operates, the activities that take place within it, employee/employer relations, etc.;
- 3) the individual's perceptions and assessments of various specific attributes; and
- 4) the objective attributes themselves.

On top of the above challenges caused by the respondent's specific characteristics, reliability error can be introduced even when *objective* responses are expected, such as in question 19 of the research instrument discussed above.

5.5 REPORTING

Each returned questionnaire was individually analysed in order to establish the company's and respondent's profiles, validate indexes and compare the Technology (T) index against the Space and Environment (SE) index, Ecology (E) index and Alternative Ways of Working (AWW) index. For this, an individual questionnaire report was created.

In most cases answers are scored from 1 (meaning poor or least favourable) to 4 (good or most favourable). The value of the index is then calculated by adding the value of each valid answered question belonging to such index and dividing it by the number of all valid answered questions. Not responded questions or not valid answers (e.g. questions with more than one answer) are not taken into consideration.

Table 5.8 shows the clustering of questions and chart type used to represent data in the report.

Table 5.8. Question clustering for pre-test report

| | Questions | Chart type |
|-----------------------------|---|--------------|
| Company's profile | Q.3, Q.4, Q.8 and Q.27 | - |
| Respondent's profile | Q.23 and Q.25 | Bar |
| T Index | Q.11, Q.12.1, Q.12.2, Q.13, Q.14, Q.15, Q.16 and Q.17 | Filled radar |
| SE Index | Q.1. (from Q.1.A to Q.1.N) | Filled radar |
| E Index | Q.20 (from Q.20.A to Q.20.E) | Filled radar |
| AWW Index | Q.9, Q.10, Q.21, Q.22 and C.F | Filled radar |
| Indexes Comparison | Comparison between indexes | Bubble |

Figure 5.5. shows a sample of the report developed during the pre-test, using actual data collected during this stage.

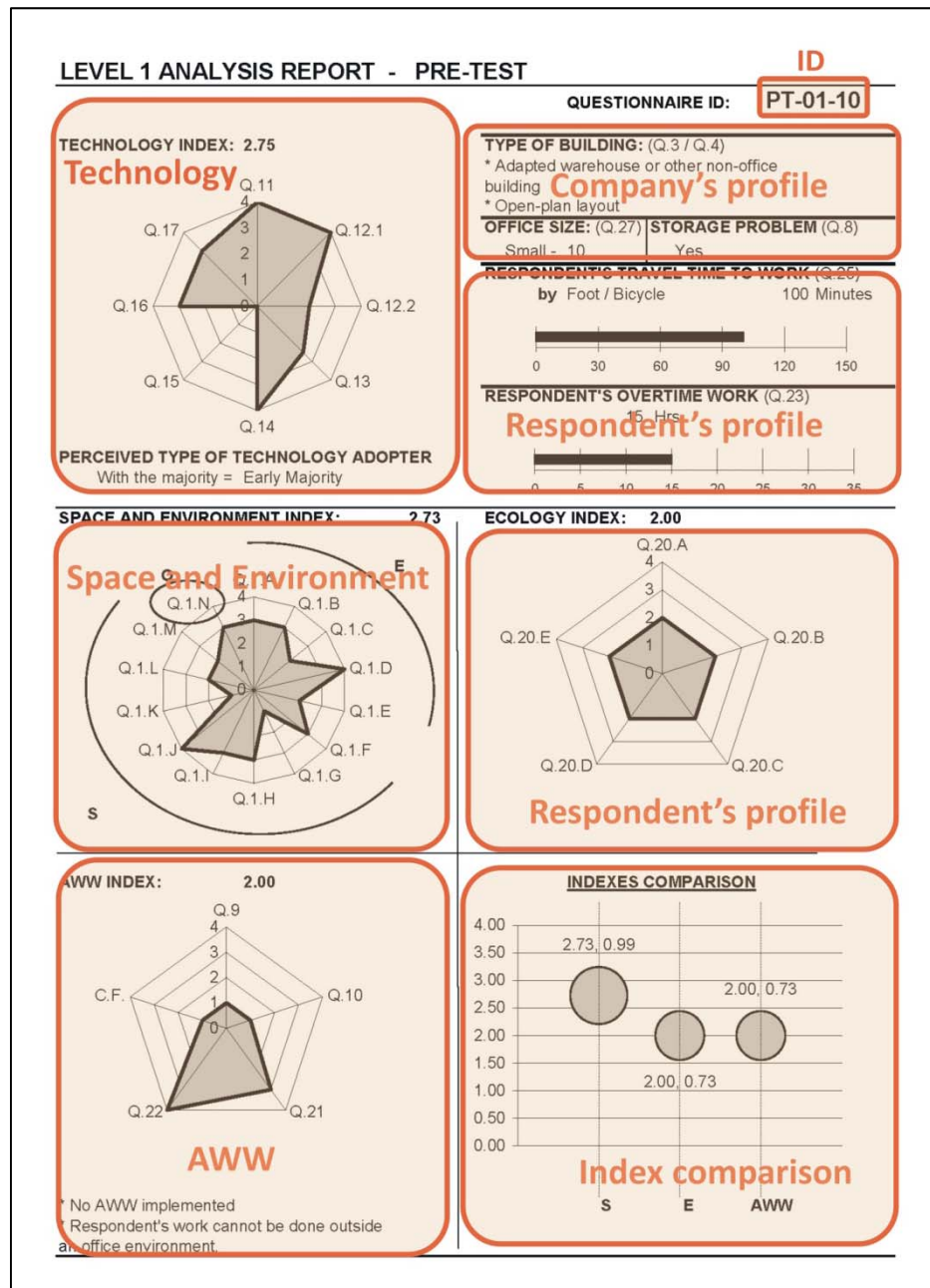


Figure 5.5. Pre-test individual questionnaire report

5.6 RESULTS OF THE TEST

Whilst the general feedback from the participants was positive, shortcomings in the questionnaire were identified. Some of the technology questions proved to be difficult for some respondents to answer. This could result in non responses or worst, inaccurate data.

It is also considered that whilst a survey is useful to the extent that it can provide the statistical significance required to understand the current state of workplace architecture and working behaviours, it lacks the ability to capture the richness of the context. Thus, it was decided to complement the survey questionnaire approach with a case study approach.

A mixed method approach is therefore adopted to overcome this problem. The refinement of the research design and instruments is detailed in the next chapter.

5.7 SUMMARY

This chapter detailed the hybrid test (between a pre-test and a pilot) specifically developed to ensure that all procedures including mailing, return rate, questionnaire (content and format) as well as reporting and analysis properly address the research questions.

As a result of this test, deficiencies were identified in the instrument itself as well as limitations inherent in the survey approach. Therefore, the questionnaire is revised in its content and format and a case study approach is incorporated in the study.

REFINEMENT OF THE RESEARCH DESIGN AND DATA COLLECTION INSTRUMENTS

CHAPTER

6

6.1 INTRODUCTION

As suggested by Babbie (1990) *“the logical arguments of the study...and all the verbal glue that holds them together”* were tested in the previous chapter. Such process identified errors and gaps in the initial research design. This chapter documents the actions taken to refine the research approach.

This chapter has seven sections. The first section details the refinement of the questionnaire. The following section describes the sampling technique developed to select the companies for the final survey. The next section discusses the mixed methods adopted for the research. The fourth section details the case study approach in general and for each of the case studies (case study protocol). Ethical considerations are documented in the following section. The sixth section explains the analysis method developed. Finally, the last section introduces the reports used to present data collected by the questionnaire and Work Sampling Diary (WSD).

6.2 REFINEMENT OF THE QUESTIONNAIRE

From the 34 questions composing the test questionnaire developed in Chapter 4, 14 were Kept (K), 13 were Modified (M) and 7 were Deleted (D) as a result of the implementation of the test implemented in Chapter 5, refer to Table 6.1.

Table 6.1. Kept, modified and deleted questions

| No.(a) | Question | | No.(b) |
|--------|---|---|--------|
| 1 | Evaluate the following parameters at your workplace (A-N): (e.g. Temp, etc) | K | 2 |
| 2 | From the following list rank the deficiencies that apply to your workplace. | D | - |
| 3 | In what type of building is your office located? | K | 1 |
| 4 | Which layout best describes your workplace? | K | 3 |
| 5 | On average, people at your workplace are: (e.g. Quite solo work, etc) | M | 4 |
| 6 | How many meeting rooms are at your workplace? | D | - |
| 7 | How would you describe the number of meeting rooms? | D | - |
| 8 | Has any space been adapted to allow for more storage space? | D | - |
| 9 | How flexible is your workplace about when employees do their work? | K | 7 |
| 10 | How flexible is your workplace about where employees do their work? | K | 8 |
| 11 | Do you use a computer at work? | M | 17 |
| 12 | Is your computer PC or Mac? | D | - |
| 12.X.1 | (P) Which is your computer's microprocessor / (M) What model is your computer? | D | - |
| 12.X.2 | (P/M) Which software and version of word processor is used at your workplace? | D | - |
| 13 | Does your workplace have Internet connection? | K | 18 |
| 14 | Does your company have a website? | K | 19 |
| 15 | Is there a wireless network at your workplace? | K | 20 |
| 16 | What type of monitors are used at your workplace? | K | 21 |
| 17 | Which scenario best describes the adoption process of new technology in your workplace? | K | 22 |
| 18 | Does your workplace rely more on faxes or e-mails to receive and send information? | M | 23 |
| 18.X.1 | (E) Generally, non-spam e-mails, are? (F) Faxes are received: | M | 24 |
| 19 | Are hardcopy documents scanned? | K | 25 |
| 20 | Are there policies in your workplace to reduce the use of: | M | 26 |
| 21 | Rank the level of bureaucracy at your workplace | K | 10 |
| 22 | Rank the level of competition at your workplace | M | 11 |
| 23 | On average, how many hours do you work overtime on a fortnightly basis? | M | 13 |
| 24 | Does your workplace have implemented AWW? | M | 27, 29 |
| 24.Y.1 | Do you personally work in the above selected arrangement? | M | 29 |
| 24.N.1 | Could most of your work be done outside an office environment? | M | 12 |
| 24.Y.2 | Which pros and cons have you experienced as a consequence of adopting AWW? | M | 30 |
| 24.N.2 | Which do you think would be the most common pros and cons of adopting AWW? | M | 30 |
| 25 | On average how much time takes you to get to work? (Return) | K | 31 |
| 26 | How do you get to your workplace? | K | 32 |
| 27 | How many people work at your company? (Including yourself) | M | 33 |

Column 'No.(a)' in the above table indicates the question number as per the test questionnaire, column 'No.(b)' refers to the question number assigned on the final questionnaire.

As a consequence of the same test, 11 questions were added to the questionnaire, refer to Table 6.2.

Table 6.2. Questions added to the final questionnaire.

| No. | Question |
|-----|---|
| 5 | Approximate percentage of time spend in the following working modes: a) Individual work and quiet thinking, b) face-to-face collaboration, c) building relationships and socialising. |
| 6 | Which is the place where most productive work related interaction is done? |
| 9 | How important is face-to-face interaction with workmates in daily activities? |
| 12 | How much do you depend on a computer for your daily work? |
| 14 | Do you take work home? |
| 15 | Do you work on weekends? |
| 16 | Are you happy with your work / life balance? |
| 28 | Which of the following you have at home? |
| 34 | Your age group: |
| 35 | Your gender: |
| 36 | Your position in the company: |

Appendix 6a includes a sample of the final questionnaire used for the data collection of the survey (Chapter 7).

6.3 SAMPLING

As discussed in Chapter 3, the desired sample size of 50 (by sub-group) needs to be increased to reduce the likelihood of a low response jeopardising the data analysis. The experience of the pre-test is used to calculate the actual number of questionnaires needed to be sent. Since the pre-tests achieved a success rate of 71%, it is assumed that the targeted 50 returned questionnaires represent 71% of the total number of questionnaires sent. In order for the 71% to equal 50 returned questionnaires, the 100% of questionnaires needs to be, coincidentally, 71 ($50 \times 100 / 71 = 70.4$, rounded up to 71). In other words, if it is expected to only receive 71% of all questionnaires sent, 71 questionnaires need to be sent to receive 50 (by sub-group).

The above method was adopted to calculate the sampling size because it is based in an actual percentage of return rate obtained by the study and it is higher than increasing the desired sample size by 20% as suggested by the literature, refer to Chapter 3.

The final number of questionnaires sent is 284, refer to Table 6.3.

Table 6.3. Sample size

| Group | Sub-groups | Desired number of returned questionnaires | Revised Sample size |
|-------------|---------------------|---|---------------------|
| Designers | Designers-CBD | 50 | 71 |
| | Designers-Suburbs | 50 | 71 |
| Accountants | Accountants-CBD | 50 | 71 |
| | Accountants-Suburbs | 50 | 71 |
| Total | | 200 | 284 |

6.3.1 Sampling catalogue

Finding a suitable catalogue from which the companies could be randomly sampled was the most challenging task of the pre-data collection stage. This was mainly for three reasons.

First, the catalogue of companies needed to be bigger (preferably at least twice the size) than the sample size by sub-group (71) in order for random sampling to be applicable, this is further explained in section 6.3.2a *Encountered problems*. Second, most professional associations' websites with catalogues of their members conceal their contact details or show limited details like an 'info@' email. Since the questionnaire is paper based, only catalogues including physical addresses could be used. Third, given that groups A and B belong to separate profession (Designers and Accountants), they were unlikely to be in the same catalogue. Differences in the way catalogues group companies and the different ways that search engines return records created problems in standardising a common process to filter companies (e.g. by city/suburb) between groups and then selecting them.

Below are some of the professional associations and institutes that were considered as sampling catalogues, but could not be used because of one or more of the above reasons.

- **Designers (Group A):**
 - Design Institute of Australia (www.dia.org.au);
 - Australian Graphic Design Association (www.agda.com.au); and
 - Directory Australia (www.directoryaustralia.com).
- **Accountants (Group B):**
 - Institute of Chartered Accountants in Australia (www.icaa.org.au);
 - National institute of Accountants (www.nia.org.au);
 - CPA Australia (www.cpaaustralia.com.au); and
 - Accountants Australia (www.accountantsaustralia.com).

On the other hand, the online version of Yellow Pages (www.yellowpages.com.au) offered a single database and a common search engine for both professions. This allowed establishing a common procedure for both groups as further discussed in section 6.3.2 *Sampling process*.

It is acknowledged, however, that companies that choose to register their service in the Yellow Pages might have a common characteristic that differ from those who do not. Whilst this could be a source of bias, it was considered that it does not affect the purpose of the research. The online version of the Yellow Pages was considered the best sampling catalogue option and was used in the study.

6.3.2 Sampling process

Following is a review of the sampling process implemented for selecting the potential respondents of the survey. It is noted that the sampling was done in early 2007 and the Yellow Pages website has since changed its navigation (and most likely its catalogue as well).

The first step was to select the geographical location of the search using a sequence of maps, from Australia to Melbourne and finally its suburbs, as shown in Figure 6.1. This first step filters the records by City/Suburb sub-group.



Figure 6.1. Yellow Pages geographic location filter (yellowpages.com 2007)

The catalogue of suburbs included 58 suburbs plus Melbourne (City). Given that Melbourne was listed in the suburbs (between Macaulay and Merri), the search for suburbs needed to be split in two: from Abbotsford to Macaulay (26 suburbs) and from Merri to Windsor (32 suburbs).

Next, the profession group (Designers or Accountants) was selected following the path shown in Figure 6.2.

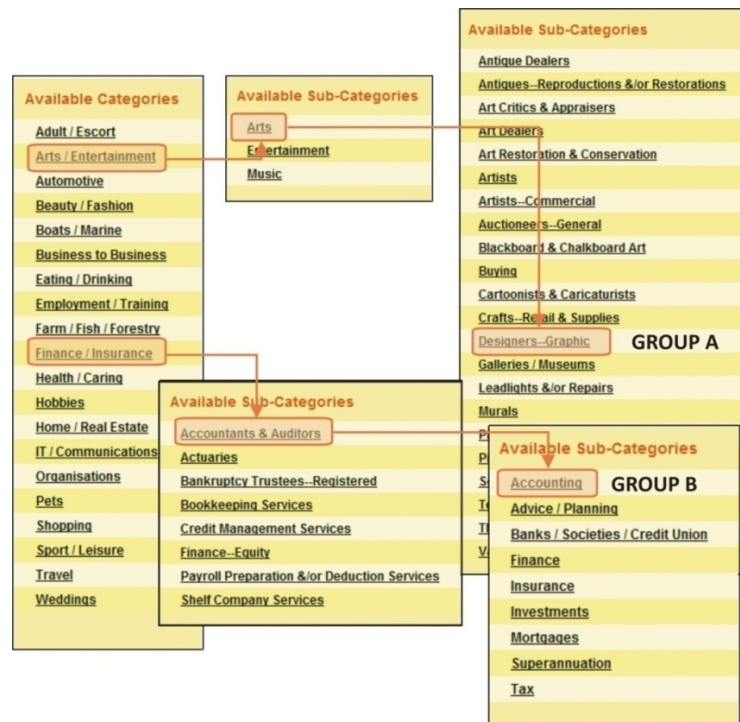


Figure 6.2. Yellow Pages categories filter (yellowpages.com 2007)

Group A was selected by following the path: Arts/Entertainment → Arts → Graphic Designers. Group B was selected by following the path: Finance/Insurance → Accountants and Auditors → Accountants.

At the completion of the above steps a list of the companies satisfying the geographical location and profession criteria was returned by the search engine. The total number of records was then registered in the 'Catalogue population' row of Table 6.4. The above process was repeated six times (because of the suburbs split) until the table was completed. At the time of the sampling there were a total of 934 Designers (group A) and 1,403 Accountants (group B) in the city and suburbs. These numbers exclude businesses servicing the suburb from other locations.

Table 6.4. Catalogue population by sub-group

| | | Location | | | Total |
|-------|--------------------------|----------|---------------------|---------------|-------|
| | | City | Suburbs 1 | Suburbs 2 | |
| | | | Abbotsford-Macaulay | Merri-Windsor | |
| Grp A | Catalogue population | 101 | 359 | 474 | 934 |
| | Number of random samples | 90 | 45 | 45 | - |
| | % of population | 89% | 13% | 9% | - |
| Grp B | Catalogue population | 403 | 320 | 680 | 1,403 |
| | Number of random samples | 90 | 45 | 45 | - |
| | % of population | 22% | 14% | 7% | - |

Next, using Microsoft Excel a column was used to list all the numbers from 1 to the specific 'Catalogue population' by sub-group (as per the above table) and input it on the 'Population' column of Table 6.5. Next, random samples were selected from this column using Excel's sampling function, and listed in 'Sampling Results' column. Since the samples were randomly selected, there was the chance that a record could be selected more than once. Thus, the number of random samples needed to be higher than the required number of samples, see 'Number of random samples' row in Table 6.4 (above). The 'Sampling Result' column in Table 6.5 (below) is not sorted, the column on the right shows these values sorted. It can be seen in this column that some numbers were in fact repeated, for example '1' appears three times and '2', '5' and '6' appear twice. The next column to the right shows unique values only. Finally, the numbers on this column were used to select the companies in the Yellow Pages catalogue and a code assigned to them. For example, as per the last row of Table 6.5, the company listed in the 23rd position in the list of accountants located in the city (Sub-group BC) was selected for questionnaire BC-15.

Table 6.5. Sub-group BC sampling (from BC-01 to BC-15 only)

| Population | Sampling Results | Sorted Result | Unique Value | Code |
|------------|------------------|---------------|--------------|-------|
| 1 | 68 | 1 | 1 | BC-01 |
| 2 | 50 | 1 | 2 | BC-02 |
| 3 | 5 | 1 | 4 | BC-03 |
| 4 | 14 | 2 | 5 | BC-04 |
| 5 | 100 | 2 | 6 | BC-05 |
| 6 | 54 | 4 | 7 | BC-06 |
| 7 | 6 | 5 | 9 | BC-07 |
| 8 | 12 | 5 | 10 | BC-08 |
| 9 | 86 | 6 | 12 | BC-09 |
| 10 | 38 | 6 | 13 | BC-10 |
| 11 | 86 | 7 | 14 | BC-11 |
| 12 | 23 | 9 | 16 | BC-12 |
| 13 | 10 | 10 | 19 | BC-13 |
| 14 | 94 | 12 | 20 | BC-14 |
| 15 | 72 | 12 | 23 | BC-15 |

6.3.2a Encountered problems

Below is a list of problems encountered whilst implementing the above method:

- **Repeated records:** the same company appeared twice in different locations (record number);
- **Geographical location filter not working properly:** despite selecting 'suburbs only' and the option no to show companies serving the suburb from other locations, companies located in the city were included in the catalogue of the suburbs;
- **Incomplete addresses:** whilst the majority of the records had a complete postal address, some records had a telephone number only;

When any of the above eventuated, the next available (and valid) record was used.

- **Unable to sample sub-group AC:** As shown in Table 6.4, there were only 101 companies in the sampling catalogue belonging to sub-group AC (Designers located in the City). Given that the number of random samples represented 89% of the population it proved impossible for the researcher (despite several attempts) to achieve even the minimum number of 71 sampled companies. This was because the number of unique records was always less than 71. Instead, to select sub-group AC one every other record was chosen. When the records finished the processes started again from the beginning, using the next available record. This method only applied to this sub-group.
- **RTS:** Some records in the catalogue were not updated. As a consequence, a total of 41 survey kits were returned with the label "RTS" (Return To Sender) or "*not longer at this address*". This is further discussed in Chapter 7.

6.4 MIXED METHODS

Despite the warning of Creswell (1994) on combining two different research paradigms, refer to Chapter 3, the testing of the survey discussed in Chapter 5 produced gaps in the collection of data that suggest a review of the questionnaire and adoption of complementary methods. Most importantly, the survey failed to retain the holistic and meaningful characteristics of real-life events, which as per Yin (1994) is a characteristic unique of case studies. As a consequence, case studies are included as part of the research methods. Case studies help explain, describe and illustrate casual links in real-life interventions that are too complex for surveys or other research methods (Yin 1994).

Creswell (2003) notes that mixed methods procedures are not too frequently implemented because they are relatively new as a distinct research approach in the social and human sciences. Mixed methods are also not popular due to the time intensive nature of analysing both text and numeric data, and the requirement for the researcher to be familiar with both quantitative and qualitative forms of research. Given the complexities involved in the inclusion of multiple methods of data and multiple forms of analysis, Creswell (2003) calls for a thorough understanding of the implementation, priority and integration of methods.

By *implementation*, Creswell (2003) refers to the order in which data is collected. The implementation can be sequential (one after the other) or concurrent (gathered at the same time). Even though there were months between the data collection of the survey and the case studies (and also months between each case study), refer to research timeline in Chapter 1, the implementation is considered concurrent. This is because the data collection of the case studies was not dependant on the results of the survey. Moreover, whilst preliminary analysis was done on the data collected by the survey before the case studies started, the bulk of the survey analysis happened after the data collection of all case studies. Creswell's mixed methods models imply that for the data collection to be sequential, the

data analysis of one method needs to be completed before the data collection of the other method starts.

The *priority* refers to choosing whether one strategy (survey or case study) has greater priority or weight over the other. The priority can be equal or skewed. Creswell (2003) argues that the decision depends, amongst others factors, on the interest of the researcher and what the investigator seeks to emphasise in the study. In this research, the case studies do not overrule the survey, nor vice versa. Instead, survey and case study results are compared and complement each other. Thus, in this study both methods have equal priority.

Finally, Creswell (2003) argues that *integration* (when the researcher mixes the data of the two methods) can occur at several stages in the process of research including the data collection, the data analysis, interpretation, or some combination of places. In this research the integration happens at the interpretation and discussion of the results (Chapter 11).

Creswell (2003) developed 6 visual models that represent the most common combinations of implementation, priority and integration. Based on the decisions taken on each of these three components, the model related to this research is the concurrent triangulation strategy, refer to Figure 6.3.

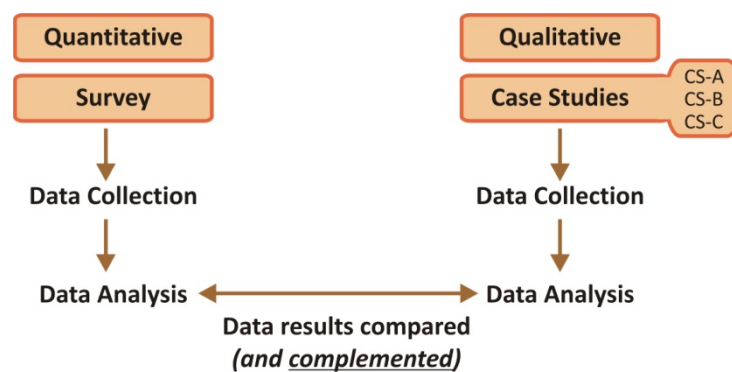


Figure 6.3. Concurrent triangulation strategy based on Creswell (2003).

The above model is commonly used when the researcher uses two different methods in an attempt to confirm, validate, or corroborate findings within a single study. This model uses separate quantitative and qualitative methods to offset the limitations inherent within one method with the strength of the other. The data collection is concurrent and there is equal priority between methods. In this strategy the results of the two methods are integrated during the interpretation phase. The results of this model have the potential to produce well-validated and substantiated findings (Creswell 2003).

However, Creswell warns that comparing the results of two analyses using data of different forms can be challenging and one of the biggest limitations of this approach. Section 6.7 *Analysis* details the process set in place to overcome this problem.

6.5 CASE STUDIES

“Case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, specifically when the boundaries between phenomenon and context are not clearly evident.”

Yin (1994)

The following section discusses the case study approach and the protocols set in place for each of the three case studies undertaken.

Yin (1994) challenges the common view that the various research strategies should be arranged hierarchically: case studies for the exploratory phase of an investigation, surveys for the descriptive phase and experiments for doing explanatory or casual inquiries. He argues that a more appropriate view is an inclusive and pluralistic one. As an observation, it is interesting to note, that Crotty (1998) groups survey research under methodology and case study under methods, refer to Table 3.2 in Chapter 3. This could be interpreted as a survey methodology using case study as a method.

According to Yin (1994), each strategy can be used for all three purposes: exploratory, descriptive, or explanatory. Thus, what distinguishes the strategies is not their hierarchy but: a) the type of research question posed, b) the extent of control an investigator has over actual behavioural events, and c) the degree of focus on contemporary as opposed to historical events. As seen on Table 3.3 in Chapter 3, each strategy addresses different types of questions. By including case studies the how and why aspects of the research questions can be addressed.

6.5.1 Case Study Design

Three case studies, each with their specific ‘case’, were proposed and undertaken:

- **Case Study A (CS-A):** Contemporary working environment
- **Case Study B (CS-B):** Work collaboration in virtual worlds
- **Case Study C (CS-C):** Alternative ways of working

Yin (1994) identifies five components of research design that are specifically important for case studies: 1) study’s questions, 2) propositions, 3) unit of analysis, 4) logic linking the data to the propositions, and 5) the criteria for interpreting the findings. Following is a general discussion of these points. Specific details on each case study are provided in each case study chapter.

6.5.1a Study questions

The purpose of the case study is to contribute to the research questions. The two main study questions and their rationale are discussed in Chapter 3. Whilst both questions benefit from the introduction of case studies, the process question: *“How is Information Technology changing workplace architecture”* is particularly benefited. As noted by Yin (1994) *“the case study strategy is most likely to be appropriate for ‘how’ and ‘why’ questions”*.

6.5.1b Study propositions

The study propositions refer to *“directing attention to something that should be examined within the scope of the research”* (Yin 1994). The study proposition of this research is that working environments are affected by changes in IT.

6.5.1c Unit of analysis

The unit of analysis is based on what the ‘case’ is (Yin 1994). As further explained by Miles and Huberman (1994) qualitative researchers often struggle with defining ‘*what the case is*’ and ‘*where the case leaves off*’. Thus, they suggest that the ‘case’ can be defined “*as a phenomenon of some sort occurring in a bounded context. The case is, in effect, the unit of analysis.*”

Whilst the three case studies have a common study proposition (above), each has a different case. The unit of analysis (case) for CS-A is the contemporary working environment. In the case of CS-B is work collaboration in virtual worlds. Finally, alternative ways of working is the unit of analysis of CS-C.

6.5.1d Linking data to the propositions and criteria for interpreting findings

According to Yin (1994) the fourth and fifth components have been the least well developed in case study research. These two areas are also particularly challenging for this research as findings will not only be interpreted and discussed within each case study, but will be discussed across case studies and the survey.

Table 6.6 shows the data collection methods used in the survey and each case study.

Table 6.6. Data collection methods

| | Questionnaire | WSD | Workstation pictures | Floor plan | PDF-form Questionnaire | Face-to-face interview | Office visit |
|--------|---------------|-----|----------------------|------------|------------------------|------------------------|--------------|
| Survey | ✓ | - | - | - | - | - | - |
| CS-A | ✓ | ✓ | ✓ | ✓ | - | - | - |
| CS-B | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ |
| CS-C | ✓ | ✓ | - | - | - | ✓ | - |

From the above table, the only research instrument applied in the survey was the questionnaire itself. On the other hand, the case studies included a variety of data collection methods to best address their individual ‘case’. The questionnaire and Work Sampling Diary (WSD) were common to all case studies. The latter is detailed in the following section 6.5.2 *Work Sampling Diary (WSD)*. The workstation pictures collected for CS-A allowed furthering the analysis of the office environment and measuring other parameters (e.g. technology footprint on workstation) difficult to do by other means. Workstation pictures were also requested for CS-B (marked with an ‘x’ in the above figure), but were not obtained. The floor plan analysis served different purposes in each case study (CS-A and CS-B). The PDF-form questionnaire was unique to CS-B and used as a mechanism to acquire preliminary data to develop the case study protocol of CS-B, see section 6.5.4 *Case Study B (CS-B) Protocol*. Face-to-face interviews provided essential information to CS-B and CS-C. Finally, a site visit was done to one of the companies of CS-B. A detailed review of the application and contribution of each data collection method is discussed within each case study chapter.

6.5.2 Work Sampling Diary (WSD)

The WSD is a specific data collection instrument designed for this research based on a similar concept used by Intel® known as observational work sampling studies.

Intel® believes that the cubicle workspace concept is starting to become obsolete in the “*era of global collaboration, evolving telecommuting technologies, and extended work hours*”

(Veda 2006). Intel identifies three business challenges faced by knowledge workers (Veda 2006):

- **Day extending:** Workers need to extend their workdays into early-morning and late-night hours to allow for real-time collaboration across different time zones with their geographically dispersed teammates, co-workers and clients;
- **Telecommuting:** Following a significant increase in the number of employees with high-speed internet access at their home, work collaboration is increasingly done from home; and
- **Space underutilisation:** Conference rooms and cubicles are often underutilised as employees have the flexibility to work off site (telecommuting).

To address these challenges, Intel® uses a variety of research methods to collect information about the work habits of their employees. Through research, the company aims to design innovative and productive workspaces that go beyond the cubicle. Their data gathering methods include: survey, interviews and observational work sampling studies (Veda 2006).

Through work sampling, researchers at Intel® can collect data about the employees' work habits and space utilisation. Work sampling involves identifying the percentage of time spent by knowledge workers working in the following modes:

- Individual work, concentration, and quiet thinking;
- Face-to-face collaboration;
- Remote collaboration;
- Building relationships with others, brainstorming, and socialising; and
- Private or confidential conversation.

However, Veda (2006) noticed from his experience applying the method to 8 pilot studies in 6 countries with 500 employee participants worldwide, that self-reported data on working modes was not always reliable. Thus, he implemented a data gathering method called observational work sampling. This method requires that a trained observer do routine observations following a predefined sampling route through the office plan. Based on the observations a statistically determined proportion of time the participant spend working in their cubicle, as well as the kinds of work they perform can be obtained.

When self-reported data was compared to the one collected through observation, Veda (2006) noted that participants tend to overestimate the time spend doing quiet work at the expense of the percentage of time working elsewhere as shown in Figure 6.4.

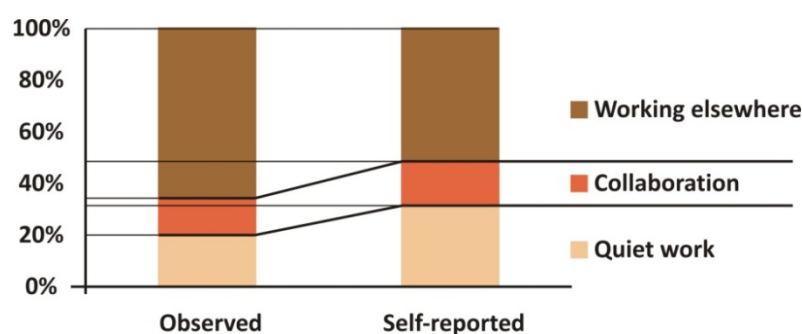


Figure 6.4. Self-reported versus observational work sampling data (Veda 2006)

Nonetheless, for the observed method to produce accurate data, a considerable number of observations are required. The following formula is used to calculate the number of observations (Veda 2006):

$$\text{Number of observations} = \frac{Z^2 \times (\text{Number of Workstations} - 1)}{(\text{Error Rate})^2}$$

Using the values suggested by Veda: $Z=1.96$ (the confidence level required) and an error rate of 0.05, a study of 5 workstations (number of participants in Case Study A) requires a total of 6,147 observations. Undertaking such amount of observations demands a team of people and developing a training programme, amongst other considerations. It was considered that the number of issues that the direct observation method raised, including companies not willing to approve a team of people walking around their office whilst observing the behaviour of their employees, would not justify, for this research, any increased accuracy of the results.

As an alternative to direct observation work sampling, a self-reporting device was developed. The Work Sampling Diary (WSD) is a paper-based diary designed for case study participants to self-report their daily work-related activities for one week (weekend included). It was a design imperative that the WSD should be easy to use, resistant (shall last for at least one week without breaking apart) and non-intrusive (should not take much space). The diary is conformed of 12 half A4 pages (including cover and instructions).

The WSD collects the following data:

- Time that participant left home;
- Time the participant arrived to work;
- Time the participant had lunch;
- Place the participant had lunch;
- Approximate percentage of time the participant spent in the following working modes (should add to 100%):
 - Quiet solo work
 - Face-to-face meetings
 - Telephone
 - E-mail
 - Outside the office
- Comments regarding the day activities;
- A four point scale of agreement with the following statement: *"I could have done today's work from home or other place outside the office"*;
- Time the participant left work; and
- Register if the participant took work home that day.

At the end of the week, an extra sheet was added in the WSD for the participant to comment on:

- The representativeness of the week; and
- Additional comments.

Refer to Appendix 6b for a sample of the WSD.

Veda (2006) then used the data collected by the work sampling method to do a “*suitability grid*” in order to identify the capabilities most needed by different employee segments, and considered how these capabilities could be adopted through a redesigned workspace. Following the implementation of this process he proposed the following changes:

- Dividing a large conference room into several smaller rooms for confidential meetings;
- Transforming two cubicles into one large workspace for three highly mobile employees. Generally, only one or two people occupy the space at any given time, providing a generous work environment in less space than three standard cubicles;
- Creating common areas near windows that might otherwise have been aisle-ways;
- Using movable whiteboard partitions to provide privacy or collaboration as needed; and
- Providing temporary ‘*cubes*’ for mobile employees who do not require a dedicated space each day.

The above recommendations were done based on the actual activities done by the employees.

Parallel to Intel’s approach, Activity Based Working (ABW) is a relatively new approach to the organisation of office space based on the tasks and activities performed by workers. ABW is enabled by mobile technologies which give people freedom to choose their work settings based on their specific needs and activities. Workspace consultants argue that early adopters of ABW have achieved significant cost savings. For example, by adopting ABW Rabobank in Europe reduced its floor space requirements by 30% and saved €70m on capex (capital expenditures). It also reduced operating costs by €8m pa (Unwired 2009).

By knowing the type of activities in which workers engage in their daily routines, the research will better understand the type of space required to perform them. The WSD aims to provide this information.

Question 5 of the survey, refer to Table 6.2, serves a similar purpose as the WSD. This question aims to collect the percentage of time spend by the respondent in three distinctive working modes. However, this question is limited to a single representative assessment of the participant as opposed to a series of more detailed inputs of the WSD. Nonetheless, this question has more responses (105) than the ones produced by the case studies (18 WSD of 12 participants).

6.5.3 Case Study A (CS-A) Protocol

CS-A aims to analyse today’s office environment. For this, an office was selected based on convenience sample, and five employees invited to participate in the study.

A case study kit was issued to participants. The kit included:

- **Cover letter:** explains the purpose of the research and involvement of participants;
- **Ethics form:** it is an RMIT University requirement that all case study participants read and sign the ethics form;
- **WSD:** 1 week work sampling diary. Participants are instructed to start using the booklet on the 22 of October 2007.
- **Questionnaire:** to be answered at any time during the work sampling week.

A sample of CS-A kit is included in Appendix 6b.

At the completion of the data collection process, participants were asked to return the signed ethic form, WSD and questionnaire.

Details on the engagement and other case study processes are discussed in section 8.2 *Case study implementation*, Chapter 8.

6.5.4 Case Study B (CS-B) Protocol

CS-B explores the development and implementation of virtual worlds as feasible environments to do work based collaboration.

Due to its unique characteristics, CS-B was the most challenging case study of the research. Following is a review of these challenges.

CS-B is based on two companies:

- **Company A:** the developer of virtual environments; and
- **Company B:** the user of the technology (client of Company A).

Thus, CS-B required approaching two different companies, with two different research instruments.

This case study is also unique because both companies are based in the UK: Company A in London and Company B in Manchester; whereas the researcher is in Melbourne, Australia.

To address these exceptional challenges a case study protocol was designed. On the 30th of July 2008 a preliminary version of the case study protocol was emailed to Company A (refer to Appendix 6c) to collect preliminary information on their technology and service that will help to produce the final protocol. Company A was also requested to nominate one of their clients for the case study.

To collect the above information a PDF form was designed. This form could be completed electronically and at the click of a button the data is automatically emailed to the researcher in an *xml* file. The following questions were included in the PDF form:

1. Company background (first established, number of employees, etc)
2. What is the concept of the company?
3. Overview of services provided. With more detail on work collaboration services.
4. How many clients use this technology for work related collaboration purposes?
5. Is work collaboration the most popular service? (if not which one?)
6. How is work collaboration service commercialised? (Monthly payments, licence, indicative cost)
7. Who is the typical work collaboration service client? (Profile, size, type of company, etc.)
8. Are there any special hardware/software requirements to run the service?
9. Is training provided?
10. What are the benefits of work collaboration services?
11. Definition of work.
12. Is work being redefined by this technology?
13. Describe the office of the future.
14. Views on the relationship between society and technology.
15. Nomination of client: Company B (Company name, contact name and details, brief description of the company).

Following Company's A input, an updated version of the protocol, was emailed to the director of the nominated company (Company B). This was done in order to collect background information of Company B to develop the final protocol prior to the site visit in Manchester, UK.

The following set of questions were developed for Company B and included in the PDF form:

1. Company background (first established, number of employees, etc).
2. Why was Company A contacted?
3. Comments on previous virtual world presence developed by Company A.
4. Comment on the in-world office presence developed by Company A.
5. What are the benefits (if any) of virtual worlds?
6. Definition of work?
7. Does Company's A technology redefine the concept of work?
8. Describe the office of the future.
9. Views on the relationship between society and technology?

A sample of the PDF forms with the above questions is included in Appendix 6c.

Figure 6.5 shows the sequence and timeline of the above process.

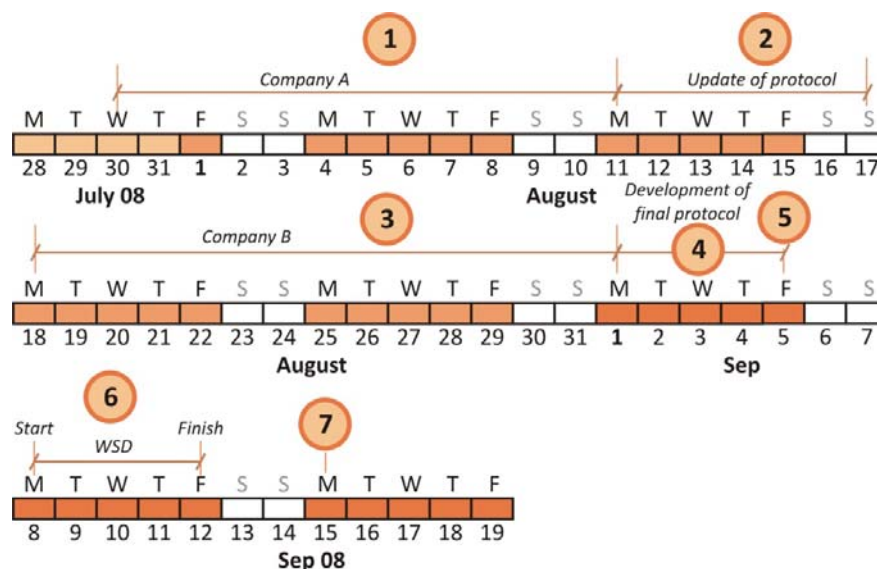


Figure 6.5. Development of CS-B case study protocol timeline (July to September 2008)

From the above figure:

1. The preliminary protocol was sent to Company A on the 30th of July 2008. The xml file (data) was expected by 11th of August.
2. Update of the protocol based on the input from Company A and nomination of one of their clients (Company B).
3. Issue of revised protocol to Company B on 18th of August 2008. The xml file was expected by 1st of September.
4. Development of the final protocol prior to site visit.
5. Site visit (Company B).
6. Implementation of WSD diary.
7. Company B to mail to researcher signed ethic forms, questionnaire and WSD.

Further details, including changes to the above protocol as a consequence of the site visit, are discussed in Chapter 9.

6.5.5 Case Study C (CS-C) Protocol

CS-C documents the experiences of an employee of a large Australian Commonwealth department who had considered working from home and was, at the time of the study, hot-desking.

This case study is based on a single participant and includes the administration of the questionnaire and WSD. A case study kit with the research background was issued to the participant, refer to Appendix 6d.

Upon receiving the above-mentioned kit, the participant agreed to participate in the research and provided (via email) the following background information.

CS-C participant is a female, married with one child, expecting a second baby (early February 2009). She lives 110km from CBD Melbourne and works for a government organisation. She considered the option of working from home in 2005. However, the requirements to work from home set by her employer included a dedicated room to work and store client information, install particular locks on the windows and doors (including internal doors), and the fitout must be assessed by her employer's security advisor and OH&S expert amongst other inspections and approvals. These requirements proved to be too onerous and costly for her and the idea of working from home was abandoned. Instead, she works part-time and hot-desks every day she goes to work. She planned to take maternity leave by early 2009.

Based on the above information an interview agenda was developed for the face-to-face interview. The following areas were included:

- Personal information (further details);
- Workplace information;
- AWW (including Teleworking and Hot-desking);
- Commuting routine; and
- Conceptual questions (e.g. nature of work, technology, etc.)

Refer to Appendix 6d for the detailed set of questions.

Further details on the implementation of this case study are discussed in Chapter 10.

6.6 ETHICAL CONSIDERATIONS

The research instruments used in this study comply with RMIT's research guidelines.

The researcher did NOT:

- use deception;
- access confidential data;
- use an interpreter;
- involve participants in any stressful or unpleasant activity during or after the data collection; or
- use participants which are in a dependent relationship with the researcher.

Confidentiality of participant responses is guaranteed by identifying the data provided by a code known only to the researcher.

On the 2nd of August 2007 the research was granted Risk level 2 approval (Register number HRESC B-905-10/06) as per classification of RMIT University's Design and Social Context Human Research Ethics Sub-Committee.

In the case of CS-B the interviews with the Directors were videorecorded with their consent. In the case of CS-C the interview was recorded (audio only) with the consent of the case study participant.

6.7 ANALYSIS

This section complements section 4.5 *Analysis of data* included in Chapter 4.

It was anticipated that the amount of results produced by the survey and case studies could be a problem unless a system to manage them was developed. Moreover, as discussed in section 6.4 *Mixed methods* results needed to be reported in a fashion that could be compared across methods. To address these requirements, the following analysis system was developed.

The first step is to write results in a standardised format. When a result is obtained (e.g. from a table or transcript analysis) it is written following the syntax explained in Figure 6.6.

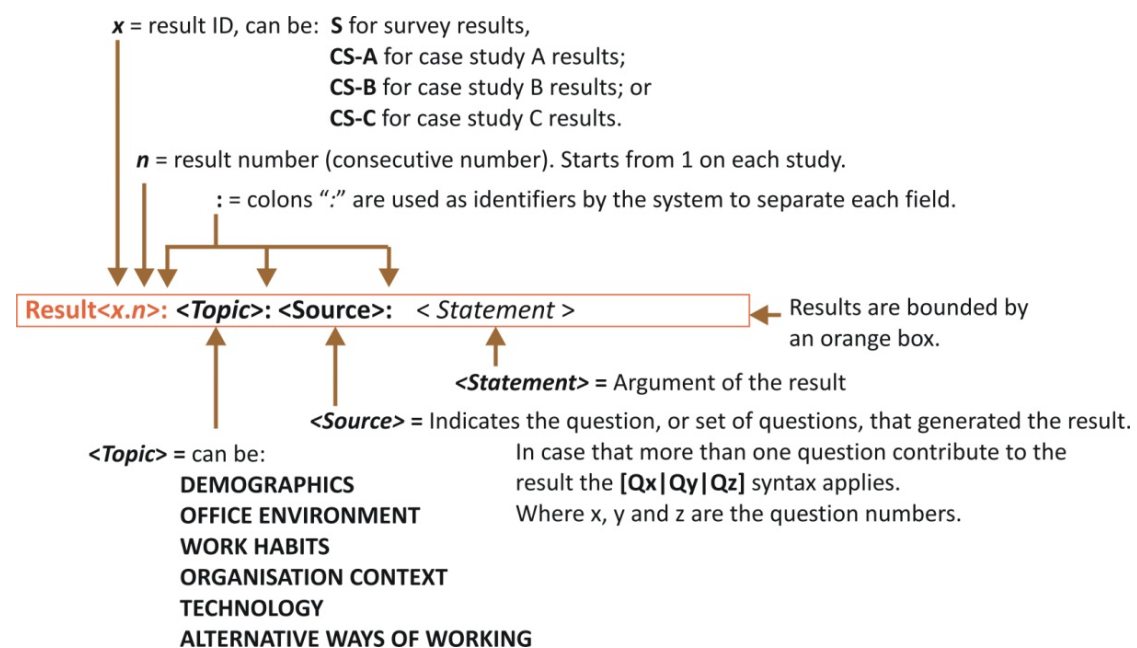


Figure 6.6. Primary research data analysis syntax

The above syntax not only provides the argument of the result (statement), but its context as well. Each result has the topic it belongs to (Demographics, Technology, etc) and other parameters associated to it as indicated in the above figure.

Using a method similar to the one used to create Table of Contents in Microsoft Word, results were grouped. Once all results were compiled, they were exported to Microsoft Excel. An important part of the syntax is the ':' (colon), which is the character that was defined to separate fields in Excel.

Then, by implementing a series of custom developed spreadsheet macros, results could be filtered by type of method (survey/case study), by topic (e.g. work habits, technology, etc.) and/or by the source (most commonly the question or set of question that generated the result).

Using question 14 (*"Do you take work home?"*) of the questionnaire, Table 6.7 shows an example of how the system works.

Table 6.7. Results table for question 14 (example)

| ID | Topic | Source | Argument |
|------|-------------|--|--|
| S.36 | WORK HABITS | Q14 | The majority of respondents (63%) take work home occasionally. Almost a quarter of respondents (24%) never take work home, whilst 9% take work home every day. |
| S.37 | WORK HABITS | [Q14 A/B SM/O] | The majority of respondents (60% to 75%, depending on the profession and position subgroup) take work home occasionally. |
| S.38 | WORK HABITS | [Q14 A/B SM/O] | The frequency by which respondents take work home is influenced more by their position than by their profession. |
| S.39 | WORK HABITS | [Q14 A/B SM/O] | Senior management respondents are more likely to take work home than respondents in other positions. |
| S.42 | WORK HABITS | [Q13 A/B SM/O] [Q14 A/B SM/O] [Q15 A/B SM/O] | Overall, senior management respondents are more likely to work longer hours and more frequently take work home and work on weekends than respondents in other positions. |
| S.49 | WORK HABITS | [Q14 Q16] | Most of the respondents (79%) that never take work home are satisfied with their work/life balance. The percentage of satisfaction decreases to 74% as respondents occasionally take work home. However, taking work home every day considerably lowers the percentage of respondents (30%) that are happy with their work/life balance. |
| S.50 | WORK HABITS | [Q14 Q16] | All of the respondents (4) that work from home are satisfied with their work/life balance. |
| S.52 | WORK HABITS | [Q14 Q16] [Q15 Q16] | Working on weekends affects the respondents' work/life balance satisfaction more than taking work home. |

The above table was automatically populated by Excel by running a query for all related results to question 14. The first row shows the result (S.36) directly obtained from analysing only data collected by question 14. The other 7 results are products of crossanalysis with other questions. In this case, question 14 is cross-analysed with question 13 (*"On average, how many hours do you work per week?"*), question 15 (*"Do you work on weekends?"*) and question 16 (*"Are you happy with your work/life balance?"*). Results produced by group analysis (by profession and position) are also shown ([A/B] and [SM/O]).

Results were filtered using various criteria within their own research method and then across both methods (including all three case studies) to facilitate discussion in Chapter 11 and produce the conclusion and recommendations discussed in Chapter 12.

An important feature of this method is that a result's ID is carried from the table or crossanalysis it originates from, to the discussion. Likewise, the direction can be reversed. By doing so, discussions can be traced back to the individual results and sources (e.g. question) that contributed to specific arguments in Chapter 11. This process is shown in Figure 6.7.

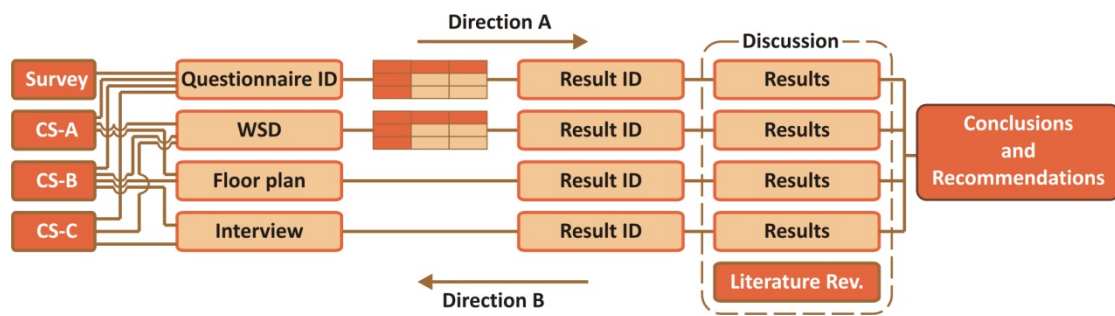


Figure 6.7. Bi-directional research method

6.8 REPORTING

Figure 6.8 shows the one-page report created for each returned questionnaire. Appendix 6e shows the questionnaire/report key.

Figure 6.9 shows the one-page report created for each WSD returned.

The above reports were especially useful in the case studies and are included in the relevant appendices.

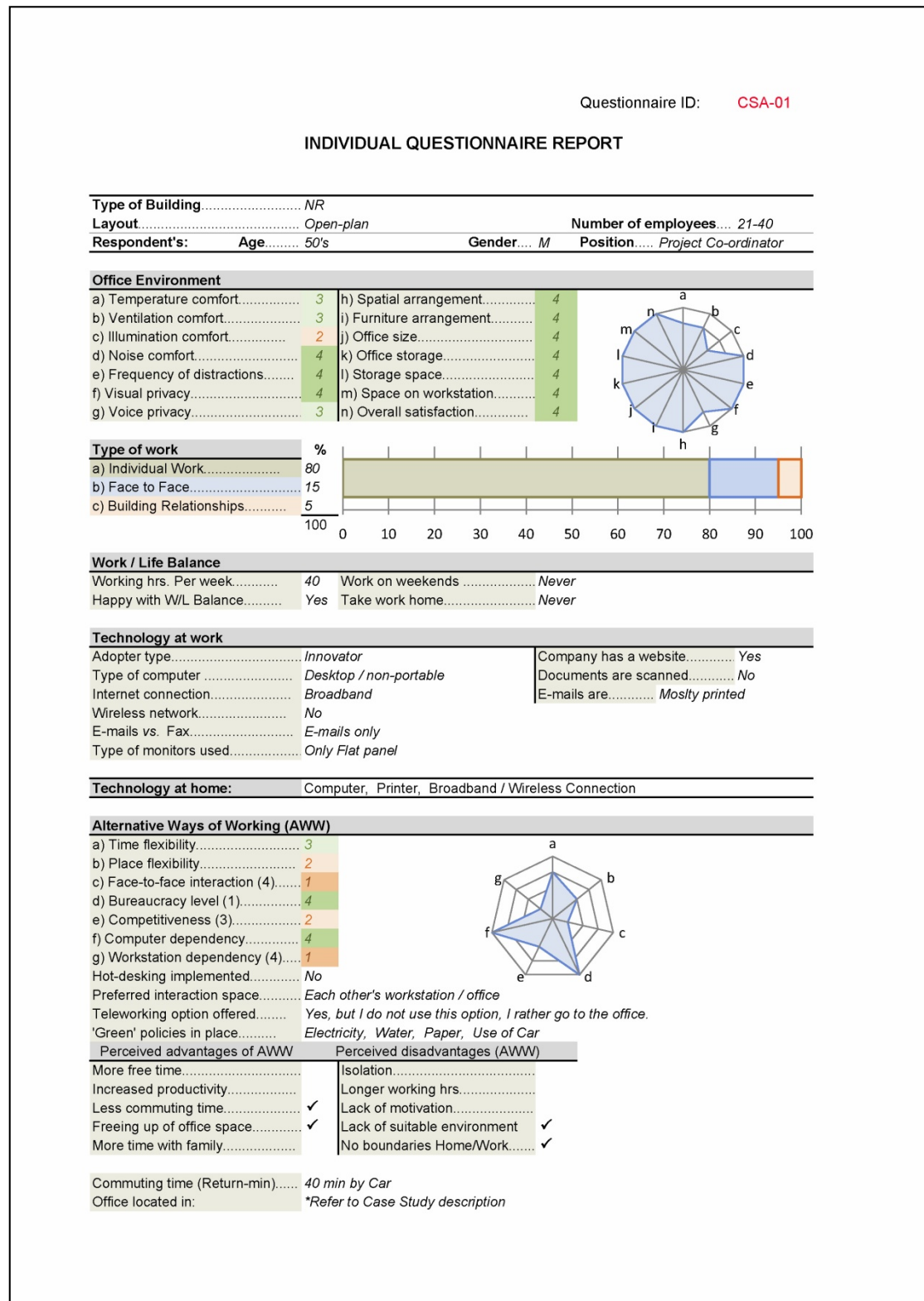


Figure 6.8. Individual questionnaire report

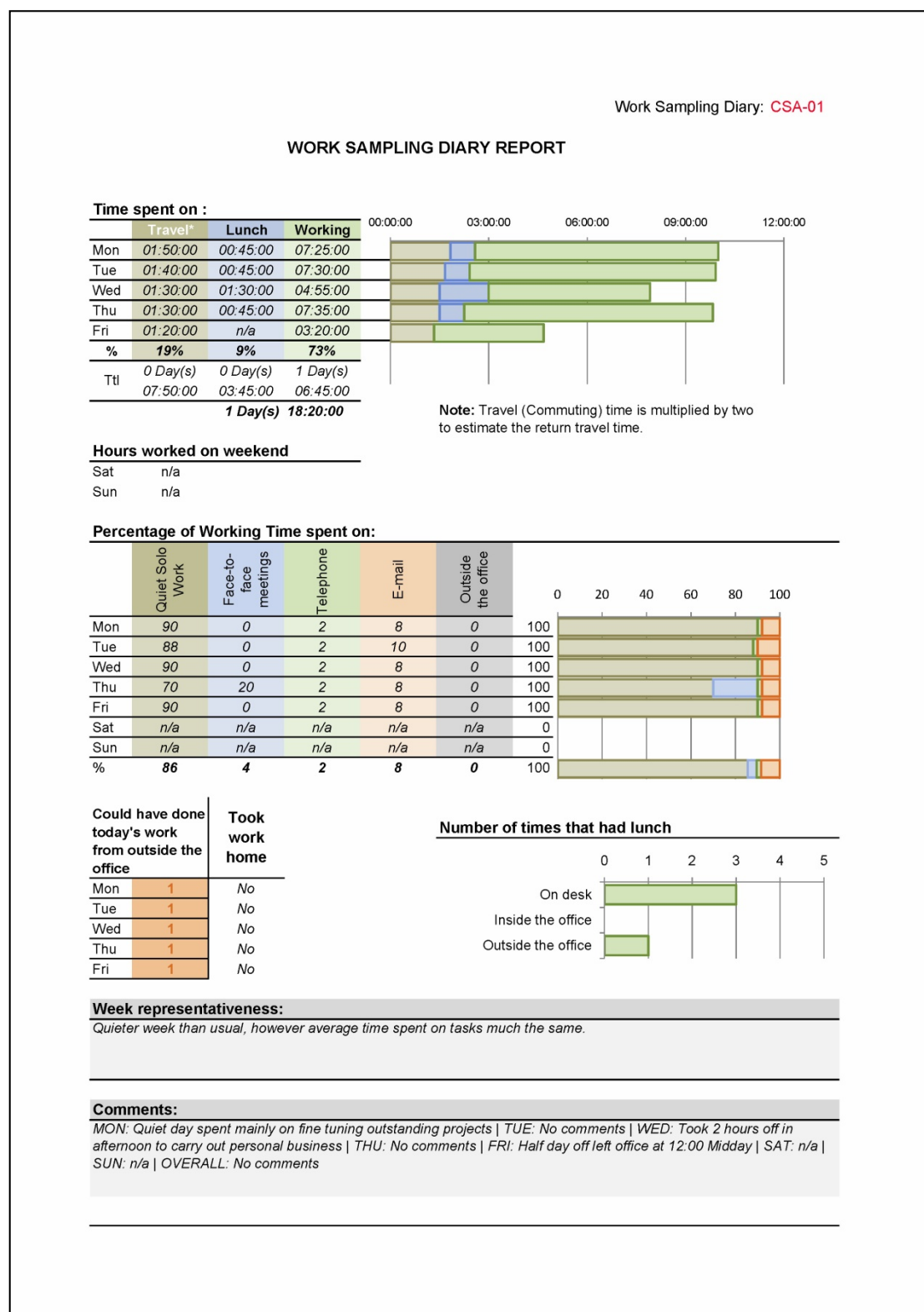


Figure 6.9. Work Sampling Diary report

6.9 SUMMARY

This chapter documented the improvements to the research design and research instrument as a consequence of the test undertaken in the previous chapter.

All processes required for the data collection process were documented including the sampling method for the survey and the protocols for the case studies.

Analysis and reporting procedures are also reviewed to make them compatible with the requirements of the newly adopted mixed method approach for this research.

The following chapter reports on the administration of the survey questionnaire, the quality of data collected and analysis of the survey data.

THE SURVEY

CHAPTER

7

7.1 INTRODUCTION

This chapter covers three distinct topics related to the survey. The first topic documents the administration of the research instrument including the mailing of survey packs, monitoring of respondents and level of accuracy achieved based on the number of respondents.

The second topic discusses the processes put in place to guarantee the quality of data used for analysis and is divided in two parts. The first part deals with the accuracy of data entry whilst transcribing the results from the returned paper based questionnaires into the computer for analysis. The second part refers to the quality of data provided by the respondents.

The third topic is the analysis of the data itself. Questions are grouped into six areas: Demographics, Office Environment, Work Habits, Organisation Context, Technology and Alternative Ways of Working. The analysis of the data gathered by such questions is analysed using the method described in Chapter 6. Given the array of tables required for analysis, supporting tables are included in appendices as indicated.

7.2 ADMINISTRATION OF THE RESEARCH INSTRUMENT

In the morning of Friday 31st of August 2007, 284 Survey Packs 1 (cover letter, questionnaire and pre-paid return envelope, refer to Appendix 6.a) were sent to the companies selected by the sampling process discussed on Chapter 6. It was expected that survey packs would reach their destination by Monday 3rd of September.

As shown in Table 7.1, the total number of returned questionnaires is 105, which represents a success rate of 37%. The process took 10 weeks and is described below.

Table 7.1. Number of returned questionnaires

| | Week | From(Mon) to(Fri) | Returned per Week | Accum | % Returned (105) | % Total Sent (284) |
|-----------------------------------|------|----------------------|----------------------|-------|------------------------|--------------------------|
| 1 st Survey pack | 1 | 3 Sep – 7 Sep | 19 | 19 | 18% | 7% |
| | 2 | 10 Sep – 14 Sep | 35 | 54 | 51% | 19% |
| | 3 | 17 Sep – 21 Sep | 7 | 61 | 58% | 21% |
| | 4 | 24 Sep – 28 Sep | 1 | 62 | 59% | 22% |
| 2 nd Survey pack | 5 | 1 Oct – 5 Oct | 27 | 89 | 85% | 31% |
| | 6 | 8 Oct – 12 Oct | 12 | 101 | 96% | 36% |
| | 7 | 15 Oct – 19 Oct | - | 101 | 96% | 36% |
| | 8 | 22 Oct – 26 Oct | 3 | 104 | 99% | 37% |
| | 9 | 29 Oct – 2 Nov | - | 104 | 99% | 37% |
| | 10 | 5 Nov – 9 Nov | 1 | 105 | 100% | 37% |
| Total | | | 105 | 105 | 100% | 37% |

As seen on the above table, by the end of Week 1, 19 completed questionnaires were received and by Week 2 another 35 completed questionnaires were also received. The second week registered the largest number of questionnaires received in a single week. By this week 19% of all questionnaires sent were returned, which accounts to the majority (51%) of all returned questionnaires (105).

During Weeks 3 and 4 the numbers started to decline, receiving only a total of 8 questionnaires. Based on the test experience (Chapter 5), the low number of questionnaires returned in these two weeks indicated that it was time to send a reminder to non-respondents.

On the morning of Friday 28 of September (end of Week 4), Survey Pack 2 was sent. The response this pack was very good. As seen in the above table, Week 5 registered 27 questionnaires, the second highest of all weeks. The following week (week 6) registered 12. By this week almost all (96%) of the total number of returned questionnaires were received. From then onwards (weeks 7 to 10) the numbers plummeted accumulating only 4 questionnaires in these four weeks. The recollection process ended on Friday 9th of November 2007. It is worth mentioning that no more questionnaires were received after such date.

Survey Pack 2 was sent to 223 respondents. Although there were only 222 (284 - 62) non-respondents as at week 5, one extra questionnaire was required as following explained.

The 222 non-respondents as at the 28th of September included 181 unreturned questionnaires as well as 41 unopened returned envelopes labelled "RTS" (Return To Sender) most of them with the legend "*No longer at this address*" written on them. This is because of the sampling catalogue containing out-of-date addresses as previously discussed in Chapter 6. The number of unreturned questionnaires and RTS by Group A/B (Designers/Accountants) is shown in Table 7.2.

Table 7.2. Number of returned questionnaires and RTS as at Week 4.

| Group | Returned as at 28 Sep | RTS | Total |
|---------|-----------------------|-----|-------|
| A | 28 | 22 | 50 |
| B | 33 | 19 | 52 |
| Unknown | 1 | - | 1 |
| Total | 62 | 41 | 103 |

It is interesting to note the similarity between groups in their number of returned questionnaires as well as RTS. This similarity is also noticeable in the overall response rate (Table 7.5)

One respondent, referred as '*Unknown*' in the above table, completed the questionnaire but removed the ID tag. As a consequence of such action, the respondent could not be related to Group A or B. If the unknown respondent belongs to Group A then there were 29 returned and 91 unreturned questionnaires for such group, otherwise there are 34 and 89 respectively for Group B, refer to Table 7.3 and Table 7.4.

Table 7.3. Returned questionnaires if 'Unknown' belongs to Group A

| Group | Returned as at 28 Sep | RTS | Unreturned | Total |
|-------------|-----------------------|-----|------------|-------|
| A & Unknown | 29 | 22 | 91 | 142 |
| B | 33 | 19 | 90 | 142 |
| Total | 62 | 41 | 181 | 284 |

Table 7.4. Returned questionnaires if 'Unknown' belongs to Group B

| Group | Returned as at 28 Sep | RTS | Unreturned | Total |
|-------------|-----------------------|-----|------------|-------|
| A | 28 | 22 | 92 | 142 |
| B & Unknown | 34 | 19 | 89 | 142 |
| Total | 62 | 41 | 181 | 284 |

Based on the above two tables the number of surveys include in Survey Pack 2 for Group A was 114 questionnaires as it was assumed that the 'unknown' belongs to Group B and thus, the Group A number of re-sent surveys comprised 22 RTS + 92 unreturned as per Table 7.4. The opposite was assumed for Group B and thus 109 questionnaires comprising 19 RTS + 90 unreturned were sent as per Table 7.3. Adding up 114 of Group A plus 109 of Group B equals 223, which explains the extra questionnaire sent.

Unfortunately, another respondent in Week 5 (from the 2nd Survey Pack) also removed the ID tag. However, given that no further survey packs were mailed, the above process was not repeated, but these two questionnaires created numerous problems during section 7.4 *Data Analysis* as they needed to be excluded from cross-analyses involving CBD/Suburb location or Profession group (A/B).

The total 41 RTS packs comprised of 12 surveys packs from sub-group AC, 10 from AS, 14 from BC and 5 from BS. Spare sampling numbers from the original sampling were assigned to all RTS. However, in some cases the number of RTS was bigger than the available spare numbers. Re-sampling was not an option as previously selected companies had the same chance to be selected again, rendering the process invalid. Thus, in such cases, the next available company to a sampled company was used.

To measure the effectiveness of including an extra questionnaire in Survey Pack 2 rather than just a reminder to respond, Survey Pack 2 questionnaires were marked with a code to help identify if respondents used the newly provided questionnaire or the previously sent questionnaire and were simply prompted to respond because of the reminder (cover letter). From the 43 returned questionnaires during the 2nd Survey Pack stage: 31 used the newly provided questionnaire. Given that 6 others were re-sampled respondents, it leaves only 6 respondents using the questionnaire provided in Survey Pack 1. This suggests that not including a new questionnaire with the reminder pack might be a wrong cost saving strategy.

Figure 7.1 indicates the number of returned questionnaires per week by sub-group: AC (Designers from the City), AS (Designers from Suburbs), BC (Accountants from the City) and BS (Accountants from Suburbs).

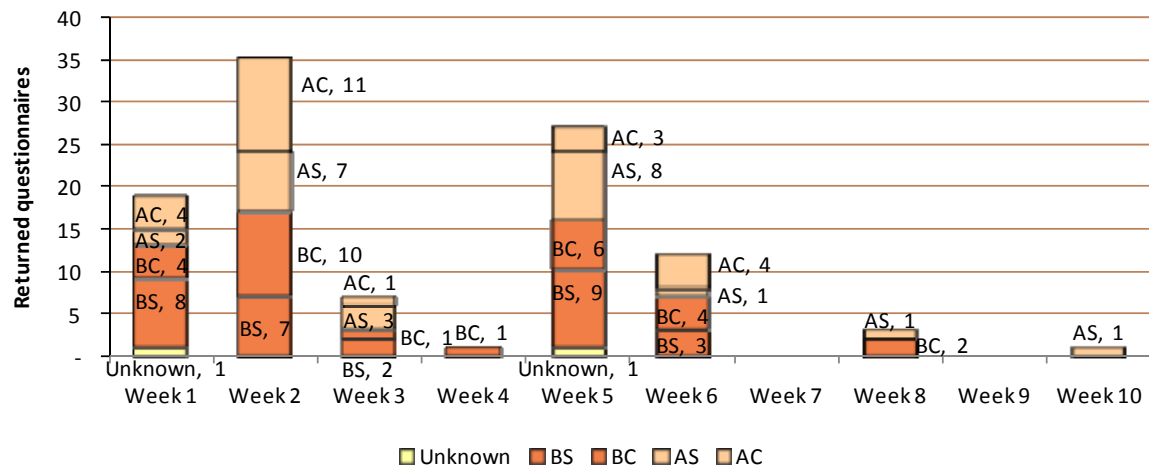


Figure 7.1. Returned questionnaires per group per week

7.2.1 Profession representation

In total, 46 Designers (Group A) and 57 Accountants (Group B) returned a completed questionnaire. Whilst Group B response is 10% higher than Group A, the response within subgroups is quite balanced. Refer to Table 7.5.

Table 7.5. Returned questionnaires per Group, subgroup and overall

| Group | Subgroup | Total Returned | Total per group | % of returned per group |
|---------|----------|----------------|-----------------|-------------------------|
| A | AC | 23 | 46 | 44% |
| | AS | 23 | | |
| B | BC | 28 | 57 | 54% |
| | BS | 29 | | |
| Unknown | | 2 | 2 | 2% |
| Total | | 105 | 105 | 100% |

7.2.2 Geographical location representation (Melbourne)

The above table, indicates that there is virtually equal representation by profession from respondents of the city and suburbs. In total there are 51 respondents from the city (AC+BC) and 52 from suburbs (AS+BS).

The suburbs represented in the survey are as per Table 7.6 (sorted alphabetically). With 11 responses, South Melbourne (S16) is the highest represented suburb, followed by Richmond (S15) with 8.

Table 7.6. Melbourne suburbs represented in the study.

| ID | Suburbs (Post Code) | Number | Melbourne Map |
|----------------------|------------------------|------------|---------------|
| C1 | Melbourne (3000) | 41 | |
| C2 | Melbourne (3004) | 10 | |
| Total City | | 51 | |
| S1 | Abbotsford | 2 | |
| S2 | Albert Park | 1 | |
| S3 | Carlton North | 2 | |
| S4 | Carlton South | 1 | |
| S5 | Carlton | 2 | |
| S6 | Chirnside Park | 1 | |
| S7 | Clifton Hill | 1 | |
| S8 | East Melbourne | 1 | |
| S9 | Fitzroy North | 3 | |
| S10 | Melbourne (3002) | 1 | |
| S11 | Middle Park | 2 | |
| S12 | North Melbourne | 2 | |
| S13 | Port Melbourne | 1 | |
| S14 | Prahran | 2 | |
| S15 | Richmond | 8 | |
| S16 | South Melbourne | 11 | |
| S17 | South Yarra | 3 | |
| S18 | Southbank | 1 | |
| S19 | Southgate | 1 | |
| S20 | St Kilda | 5 | |
| S21 | West Melbourne | 1 | |
| Total Suburbs | | 52 | |
| Unknown | | 2 | |
| Total | | 105 | |

Background based on Google Maps 2008.

With the exception of one suburb, all are located within 6 km from the Central Business District (CBD). Chirnside, with only one respondent, is located 40 km from the CBD, see above figure.

Although Melbourne 3002 (C2) is outside the main CBD area, it runs along St. Kilda Road. This road shares similarities in terms of the building infrastructure with the CBD and it is thus, considered to be part of the city for purpose of this study, see above figure.

7.2.3 Statistical representation

Although the success rate of the main survey (37%) is considerably lower than the test (71%), refer to Chapter 5, the overall number of returned questionnaires achieved statistical representation.

Table 7.7 shows the accuracy achieved based on the number of returned questionnaires and the population homogeneity based on Vaus (1995) as previously discussed in Chapter 3.

Table 7.7. Accuracy based on sample size and population homogeneity

| Percent of population expected to give particular answer | 5 or 95 | 10 or 90 | 20 or 80 | 30 to 70 | 40 to 60 | 50-50 |
|--|---------|----------|----------|----------|----------|-------|
| Acceptable sampling error | 4%-5% | 6% | 8% | 9% | 9%-10% | 10% |

The above table indicates the acceptable sampling error based on 105 returned questionnaires based on the expected homogeneity of the sample. Since it is expected that groups are dissimilar between each other, a 50-50 homogeneity is expected.

Based on the homogeneity of the sample size and the number of returned questionnaires the sampling error for this study is 10%.

7.3 DATA QUALITY

This section discusses the processes put in place to guarantee the quality of data used for analysis. The first part discusses the anticipated sources of error whilst transcribing the results from the returned paper-based questionnaires into the computer for analysis. The second part of this section refers to the quality of data provided by the respondents.

7.3.1 Transcribing data

Given the decision taken to use paper-based questionnaires rather than online surveys, (refer to Chapter 4) all collected data needed to be input into the computer for statistical analysis.

Although the final questionnaire comprised of 36 questions in total, respondents could select more than one answer in some questions. As a result, each questionnaire has a total of 67 entries. Since 105 questionnaires were returned, the total number of data entries is 7,035 (105 x 67). The likelihood and the consequences of introducing error whilst transcribing just over seven thousand data entries were deemed a risk to the research.

This risk relies on the principle that the research conclusions will be based on the analysis of the data input into the computer, not on the actual data recollected. Hence, for these two sets of data to be identical, human reliability (in terms of the propensity to make errors) should be managed. Furthermore, with such a large number of entries to be made it was considered not a matter of *if* errors would be made whilst transcribing the data, but *how many* and to *what extent* would they affect the research.

Following is a discussion of human error embedded in research due to errors incurred whilst transcribing data. The following discussion together with the developed quality control system were documented in a conference paper entitled *“Human reliability as a source of error in research”* presented at the ARCOM 2008 conference, refer to Chapter 1.

7.3.1a Definition of error

An error essentially involves a deviation of some kind, whether it is a departure from the intended course of action, departure from a path of actions planned toward a desired goal or deviation from the appropriate behaviour at work (Reason and Hobbs 2003). When a research project commences, there is usually a general intention to *“get it right the first time”* (Manavazhi 2004). However, as individuals make all the decisions regarding what is

done, how it is done and who does it, all errors originate from humans. Therefore all errors are ultimately human errors (Kaminetzky 1991; Sunyoto and Minato 2003).

This implies that research is prone to the inevitability of human error. In theory this inevitability may be the result of a social cognitive distribution, where everyone has his or her own unique way of thinking despite the teaching and training of others (Busby 2001). Performing tasks during research will inevitably require cognitive effort from the researcher(s). Cognitive effort involves devoting mental resources to process information and form beliefs (Busby 2001). Therefore, a basic principle of managing errors is that mistakes can be made by the best of us (Reason and Hobbs 2003).

Skill (or performance-based error) is of particular concern in the research process. This type of error is associated with lapses arising from carelessness or neglect. Errors may involve recognition (misidentifications or non-detection), memory (lapses) or attentive (distractions or slips during action) failures in processing information (Kaminetzky 1991; Reason and Hobbs 2003). A concern is that no countermeasure exists for errors in general (Reason 2002). Attention has previously focussed on human error within systems engineering but with no apparently obvious approach emerging toward the subject (Busby 2001). To this end, the focus here is on the input errors committed during research.

Importantly, errors are not only caused by deficiencies in individual skill and experience, nor are they always the result of isolated mental glitches (Reason and Hobbs 2003), but are also consequences of surrounding local circumstances and conditions, including the task, tools, equipment and the general working practices, which influence actions and provoke errors (Josephson and Hammarlund 1999; Love et al. 2007). Errors may also arise from error-provoking conditions (or traps) within the research itself.

Although beyond the scope of this discussion, it is worthwhile emphasising that any errors committed during research will result in rework if they are identified. Love, Edwards and Smith (2006) collectively define rework as: *“the unnecessary effort of redoing a process or activity that was incorrectly implemented the first time”*. Rework is only performed when the benefits of performing it are deemed to outweigh the ramifications of not performing it (Manavazhi 2004). The additional risks of research task interruptions to address rework are that individuals may either forget what it is they were doing or skip performing particular steps in an attempt to compensate for the resultant delay (Love et al. 2007). Undetected errors, of course, remain as a “ticking bomb” for the research and its outcomes.

The following section describes an investigation into data input errors for the questionnaire survey research instrument.

7.3.1b Identifying, containing and quantifying input errors

In order to ensure that data inputted into the computer was identical with those on the returned questionnaires, a simple and cost-efficient system was developed. This system utilises both the interpretative capability of humans and the data checking capacity of computers. Figure 7.2 outlines the developed system implemented not only to contain, but also to quantify the occurrence of input errors whilst transcribing a hard-copy questionnaire into the computer.

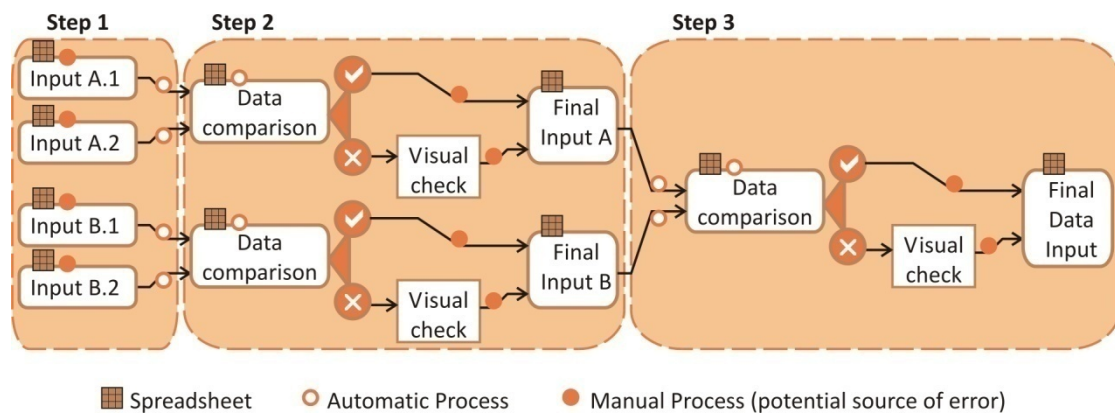


Figure 7.2. The input process

Step 1: Data Input. Using a spreadsheet, a matrix was created listing all the questions in the first column and all the questionnaire identification numbers (ID) in the first row. The response code (the number next to the tick box) was input in between these two to relate respondents to their answers. Given that this step was performed by two persons (A and B), a procedure was developed and strictly followed in order to reduce errors committed as a consequence of each person adopting different approaches. Questionnaires were input in exactly the same order by Person A and B.

Step 2: Data comparison. A third spreadsheet, refer to Figure 7.2 automatically compares each of the values of 'Input 1' and 'Input 2', which contains both inputs from the same person. If the values are the same (x), it returns a "True" value. If one of the values is different, it returns a "False" value. Table 7.8 illustrates the system's logic.

Table 7.8. Possible data comparison scenarios and results

| Input 1 | Input 2 | Value |
|---|---|--------|
| X | X | True |
| X | Any value other than X | False |
| Any value other than X | X | False |
| Any value other than X and different from Input 2 | Any value other than X and different from Input 1 | False |
| Any value other than X and same as Input 2 | Any value other than X and same as Input 1 | True * |

Conditional formatting (green-True / red-False) made it easier to identify which entry values, if any, were different. However, the system does not reveal which value is wrong, hence a visual check using the scanned questionnaire was performed to identify whether Input 1 or 2 is correct. Once the input errors are identified, correct values are manually copied and pasted into the 'Final Input' spreadsheet. Being a manual process this is a potential source of input error in itself.

The last row of the above table, marked with an asterisk ('*') denotes any embedded flaws within the system. The system will return a 'True' value as long as the two sets of inputs are identical. However, a true value will be misleading when the person performs the exact same error twice. Whilst this is the least probable form of input error to be committed, it creates a degree of uncertainty because a 'True' value in this instance does not always mean a correct value. This is because the system only reveals that the second data input truly

matches the first data input, and will not match the correct values provided by the respondents themselves in the returned questionnaires when the same input errors are committed for the same question(s) in both data inputs.

Step 3: Cross data check. The objective of this step is to reduce as far as possible, the probability of two identical errors, as noted above, entering the 'Final Input' spreadsheet. However, it is important to note that whilst this system ensures a reduction in input errors, it cannot ensure that these are eliminated entirely, as there will always be the possibility, however small, that Person A and B will commit the same input error. This step compares values between 'Final Input A' and 'Final Input B' and automatically identifies differences between the two, refer to Figure 7.2. As per Step 2 above, conditional formatting is used where the values within the green cells are in this instance deemed correct and those values within the red cells are visually checked against the scanned questionnaires returned.

Although every received hard-copy questionnaire was scanned, the manner in which the answers were registered by respondents made it difficult to automate the reading process (e.g with optical character recognition – OCR – technology). Representative responses that highlight the need of a person, rather than a computer, to decipher the questionnaires are illustrated on Table 7.9.

Table 7.9. Representative problems for automated data reading

| Type | Example |
|----------------------------|---------|
| Ambiguous responses | |
| Amended responses | |
| Illegible responses | |

7.3.2 Number of errors

The system detected a total of 138 errors for both sets of data entries (Person A and B). This is quite a small number when compared with the overall number of data entries. As previously mentioned, each of the 105 questionnaires had 67 data entries; given that each questionnaire was input twice by Person A and twice by Person B, the total number of entries is 28,140 (105x67x2x2). Thus, these 138 input errors represented only 0.5% of the total data entered.

Figure 7.3 indicates the number of errors by stages. In Step 1 Person A incurred in 27 errors in Input 1 and 35 in Input 2. Person B incurred in 22 errors in Input 1 and 16 in Input B. It is interesting to note that Person A made one identical error (same error in two different inputs) shown as 2 in the figure below and Person B did 14 identical errors, shown as 28 in the figure below. These errors were only possible to identify in Step 3. As previously mentioned, however, it is unknown if there are any identical errors between Persons (same mistake, in the same question, in the same questionnaire committed by both persons).

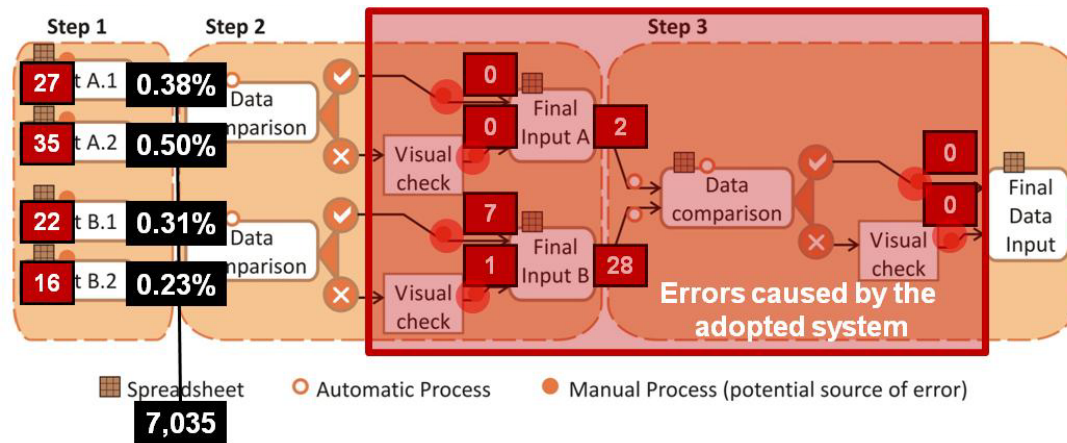


Figure 7.3. Number of errors by stage

If no data comparison had taken place and the worst case scenario for Person A 36 (35 errors in Step 1 + 1 error in Step 2) and for Person B 36 (22+14=36) were instead hypothetically taken into consideration, the percentage of errors in both cases would have also been 0.5% (of 7,035), but there would have been no way of quantifying these hypothetical errors, let alone containing them. It is noted that for this calculation, errors committed whilst copying and pasting data from one spreadsheet to another were not taken into consideration as they only occurred as part of the data checking process.

In order to assess whether a relationship exists between the time taken to input data and the quantity of input errors committed (i.e. do faster inputs produce more errors?), the time taken by each person to input data from each questionnaire received was monitored and analysed. A discussion on the number of errors committed through time is offered in Appendix 7a.

7.3.2a Impact of input errors

As previously mentioned, the total number of identified errors is 0.5% of the total input data entries. However, for several questions more than one input error was committed for the same question. It was subsequently discovered that the questions where these input errors occurred had more impact, and were of greater relevance, on the findings revealed from each question than the absolute number of committed input errors identified.

Given that 105 questionnaires were returned, each question had 105 answers related to it. If one answer was inputted incorrectly 0.95% impact of the input error is introduced. Similarly, if two responses within the same question are incorrect, the impact percentage of the input errors increases to 1.90% and so forth.

Table 7.10 illustrates that Person A committed 1 input error per question for 18 questions, 2 input errors per question for 10 questions, 3 input errors per question for 5 questions, and 4 and 5 input errors per question for 1 question each. In comparison, Person B had committed 1 input error per question for 27 questions, 2 input errors per question for 4 questions, and 3 input errors per question for 1 question. The column furthest right in Table 7.10 illustrates the impact percentage of the input error(s) introduced to the same question.

Table 7.10. Quantity of input errors committed per question

| Quantity of input errors in the SAME question | Person A | Person B | Impact % of input error |
|---|---|--|-------------------------|
| 1 | 18 | 27 | 0.95% |
| 2 | 10 | 4 | 1.90% |
| 3 | 5 | 1 | 2.86% |
| 4 | 1 | - | 3.81% |
| 5 | 1 | - | 4.76% |
| Total | $18 \times 1 + 10 \times 2 + 5 \times 3 + 1 \times 4 + 1 \times 5 = 62$ | $27 \times 1 + 4 \times 2 + 1 \times 3 = 38$ | |

As errors familiar in nature continue to occur within any system, the tendency is for “*recurrent error traps*” to materialise (Love et al. 2007). The impact of this is identified by Reason (2002) who links error traps to a simple photocopier machine and demonstrates that it is indeed possible to establish these error traps (Reason 2002). Under this context, one question in the questionnaire was identified as an error trap as it registered 6 errors overall, 3 by Person A and 3 by Person B. Therefore, the questions where most of the input errors were committed represent error traps as they contain input error-provoking conditions. Additionally, the impact of input errors committed per question is further magnified when a correlation between two variables is performed.

Through the implementation of the above process it was concluded that studies that rely on paper-based surveys to recollect data have the embedded risk of introducing error to the research conclusions due to deficiencies in human reliability at the data entry stage. In order to reduce this risk, appropriate measures should be adopted to ensure that the data registered by respondents on the survey instrument is identical to that inputted within the system tool (i.e. software) used to analyse such data.

The consequences of a relatively small impact percentage of the input error(s) committed (0.5% in the experiment) in transcribing data can affect the overall research findings (~5.0%). Understanding where to direct the bulk of error containment focus will therefore benefit the research deliverables. Addressing the error traps within the research instrument itself will lead to improvement in the reliability and credibility of the research outcomes. Questions where the majority of all input errors are committed represent error traps within the research as they contain conditions that provoke input errors.

Although it is suggested that online surveys eliminate altogether this type of error as well as the time required for transcribing data, this may not be a feasible means of data collection for every form of research. Online surveys may also introduce other types of error. For example, respondents may be required to click on buttons to record answer options, and then proceed to subsequent questions. However, moving on by means of the mouse scrolling facility may actually change the button option recorded for the earlier question. If this goes unnoticed by the respondent an error occurs.

If insufficient care is taken to adopt an appropriate means of data collection, this can potentially introduce other sources of input error (e.g. research bias) which may be more difficult to manage than those input errors managed within this research.

7.3.3 Quality of data provided by respondents

Each of the returned questionnaires was examined to identify any response that could introduce error to the analysis of data. Appendix 7b offers a detailed comment on this

analysis and shows the actual responses and action taken on each case. The most common issues identified are:

- **New code (option):** In some cases respondents handwrote their preferred answer when they considered that the offered options did not include their response. Rather than a problem, this type of flexibility is considered advantageous for paper-based questionnaires over on-line surveys. When various respondents provided the same *new* option, such option was adopted for the study. However, it is acknowledged that by doing so, error may have been introduced to the study as some respondents that chose the offered answers might have chosen the *new* option if it had been clearly available to them.
- **Multiple selections on expected single selection:** Some respondents ticked more than one box, especially on the scales, to locate their response in the middle of the two boxes, commonly the centre point. However, as previously mentioned in Chapter 4, scales without central point were preferred to avoid respondents adopting a neutral position and force them to take a side.

Table 7.11 lists the 15 questions that experienced some kind of problem. In total 56 responses across the 15 questions were affected. However, only 8 responses across 5 questions could not be used for analysis. Refer to Appendix 7b, section 2 for more details.

Table 7.11. Summary of affected questions

| Question ID | Number of Questionnaires affected | Comment | Data can be used | Valid answers per question |
|--------------|-----------------------------------|---|------------------|----------------------------|
| 3 | 8 | New code (option) adopted | Yes | All (105) |
| 8 | 1 | Ambiguous response | No | 104 |
| 9 | 1 | Response interpreted within the context of the answer. | Yes | All |
| 13 | 2 | Data grouped into ranges | Yes | All |
| 17 | 7 | New code (option) adopted | Yes | All |
| 18 | 15 | Responses standardised | Yes | All |
| 19 | 1 | Response interpreted within the context of the question | Yes | All |
| 21 | 2 | Ambiguous response | No | 103 |
| 23 | 2 | Ambiguous response | No | 103 |
| 28 | 3 | Response interpreted within the context of the question | Yes | All |
| 29 | 9 | Response interpreted within the context of the question. New codes (options) adopted | Yes | All |
| 31 | 1 | Response interpreted within the context of the question | Yes | All |
| 32 | 2 | Ambiguous response | No | 103 |
| 34 | 2 | Response interpreted within the context of the | Yes | All |
| 35 | 1 | Ambiguous response | No | 104 |
| Total | 56 | | | |

7.4 DATA ANALYSIS

Once data had been checked through the implementation of the above methods, the data collected from the survey were analysed. Each question is presented with its respective frequency table. When required, crossanalysis (analysis between tables) as well as correlation analyses were done. The bulk of statistical analysis and supporting tables are included in Appendix 7c.

Results are coded and presented using the syntax and format detailed in Chapter 6.

7.4.1 General demographics

Respondents skewed to specific groups in terms of general demographics. The survey response is mainly represented by males (64%), people in between 20-49 years old (62%) working in companies with 10 or less employees (57%) and working as directors (55%).

General demographics data were collected by questions numbers 33, 34, 35 and 36 of the questionnaire. Following are details of each variable.

7.4.1a Gender (Q35)

Data collected by question:

35 Your gender 1 ☐ Male 2 ☐ Female

Table 7.12 shows the frequency of responses to question 35.

Table 7.12. Q35 Frequency table: Gender of participants

| Code | Description | Frequency | % |
|-------|-------------|---------------------|------|
| 1 | Male | 67 | 64% |
| 2 | Female | 37 | 36% |
| Total | | 104(1) ¹ | 100% |

From the above:

Result S.1: **DEMOGRAPHICS: Q35:** The majority of respondents (64%) are males.

7.4.1b Age range (Q34)

Data collected by question:

34 Your age group 1 ☐ 20's 2 ☐ 30's 3 ☐ 40's 4 ☐ 50's 5 ☐ 60's 6 ☐ 70's +

The most represented age group is 50's (30%), closely followed by the 30's (28%) and 40's (27%) age groups. No person in their 70's or more was represented in this study. The majority (62%) of respondents were between 20 to 49 years old. Respondents' ages are as per Table 7.13.

Following RMIT ethic guidelines no person under 18 was allowed to participate in the study.

¹ This question registered one invalid response. The total number of responses taken into account for this question is 104. Invalid questionnaire: AC-12.

Table 7.13. Q34 Frequency table: Respondent by age group

| Code | Age range | Frequency | % | Group % |
|-------|-----------|-----------|------|------------------|
| 1 | 20's | 8 | 8% | 20's-40's 62% |
| 2 | 30's | 29 | 28% | |
| 3 | 40's | 28 | 27% | |
| 4 | 50's | 32 | 30% | 50's+ 38% |
| 5 | 60's | 8 | 8% | |
| 6 | 70's+ | - | - | |
| Total | | 105 | 100% | 100% |

As show in Table 7.14 Generation X (as at 2007) has the highest representation in the study followed by Baby Boomers.

Table 7.14. [Q34|Generation] Frequency table: Representation of respondents by Generation

| Generation | Born between | Age range as at 2007 | Frequency | % |
|--------------|--------------|----------------------|-----------|------|
| Baby Boomers | 1945-1963 | 44-62 | 40 | 38% |
| Generation X | 1964-1977 | 30-43 | 57 | 54% |
| Generation Y | 1978-1994 | 18-29 | 8 | 8% |
| Total | | | 105 | 100% |

From the above:

Result S.2: DEMOGRAPHICS: Q34: The majority of respondents (54%) belong to Generation X, followed by the Baby Boomers generation (38%). Only 8% of respondents belong to Generation Y.

7.4.1c Company Size (Q33)

Data collected by question:

33

How many people work at your company? (Including yourself)

1 ☐ 1-10
2 ☐ 11-20
3 ☐ 21-40
4 ☐ 41-60
5 ☐ 61-99
6 ☐ 100-150
7 ☐ 151+

In this study the size of the company is measured by the number of employees. Ranges are grouped into *Small* (1-20 employees), *Medium* (21-99) and *Large* (100+). Refer to Table 7.15

Table 7.15. Q33 Frequency table: company size

| Code | Range | Frequency | % | Group % |
|-------|----------------|-----------|------|---------------------|
| 1 | 1-10 employees | 60 | 57% | 1-20 Small 72% |
| 2 | 11-20 | 16 | 15% | |
| 3 | 21-40 | 13 | 12% | 21-99 Medium 15% |
| 4 | 41-60 | 1 | 1%* | |
| 5 | 61-99 | 2 | 2% | |
| 6 | 100-150 | 4 | 4% | 100+ Large 13% |
| 7 | 151+ | 9 | 9% | |
| Total | | 105 | 100% | 100% |

The majority of companies (57%) have 10 or less employees, and 72% of all companies have 20 or less employees (*Small* group). There is an undersized representation (7%) of companies ranging from 41 to 150 employees which are composed by three consecutive ranges (4, 5 and 6). The sum of these ranges is smaller than any other single range.

Result S.3: DEMOGRAPHICS: Q33: The majority of respondents (57%) work in companies of 1-10 employees.

Result S.4: DEMOGRAPHICS: Q33: Most of the respondents (72%) work in a *Small* company (20 or less employees), followed by 15% working in a *Medium* company (21 to 99 employees). The remaining 13% work in *Large* companies (100+ employees).

A crossanalysis between Group C/S (City/Suburb) and the size of the company, refer to Table 7.16, indicates that almost all large companies (92%) are located in the city whilst the majority (57%) of small companies prefer the suburbs. Medium companies are equally distributed between the City and Suburbs.

Table 7.16. [Q33 | C/S] Crossanalysis: Geographical location by company size

| Description | Frequency | | | | | | Total |
|-------------|-----------|------|--------|------|-------|------|---------------------|
| | Small | | Medium | | Large | | |
| City | 32 | 43% | 8 | 50% | 11 | 92% | 51 |
| Suburb | 43 | 57% | 8 | 50% | 1 | 8% | 52 |
| Total | 75(1) | 100% | 16 | 100% | 12(1) | 100% | 103(2) ² |

Result S.5: DEMOGRAPHICS: [Q33 | C/S]: Almost all large companies (92%) prefer a city location. The majority of small companies (57%) tend to be located in the suburbs. Medium companies are equally divided (50%) between city and suburb locations.

Respondent AS-10 is the only company with 100+ employees which is located in a suburb (S9-Fitzroy North).

7.4.1d Respondent's position (Q36)

Data collected by question:

36
Your position in the company: (e.g. director, manager, sales, production, secretarial, etc.)

This was one of the few open-ended questions on the survey. However, all responses were standardised into 8 positions and clustered in two groups in order to allow crossanalysis between the respondents' position and other variables of the survey. The standardised positions were then grouped in two groups: *Senior Management* (SM) and *Other* (O). The SM group clusters decision-maker positions and it is composed by Directors, Managers, Partners and Owners. The O group clusters the remanning non-decision making positions:

² The outstanding balance (2) in the total is due to the two 'unknown' respondents. However, whilst their group (city/suburb) is unknown, their size are '100+' for XX-01 and 'less than 20' for XX-02. Thus, it could be inferred that XX-01 is located in the city and XX-02 in the suburbs. However, this speculation is not adopted in the analysis.

Administration & Finance, Secretarial, General Staff and Human Resources. Refer to Table 7.17.

Table 7.17. Q36 Frequency table: respondents' position

| Position | Frequency | % | Group |
|--------------------------|---------------------------|-------------|--------------------------|
| Director | 58 | 55% | Senior Management 80% |
| Manager | 16 | 15% | |
| Partner | 7 | 7% | |
| Owner | 3 | 3% | |
| Administration & Finance | 8 | 8% | Other 20% |
| Secretarial | 8 | 8% | |
| General Staff | 3 | 3% | |
| Human Resources | 1 | 1% | |
| Total | 104(1)³ | 100% | 100% |

As per the above table, the SM group represents 80% of all respondents.

Result S.6: DEMOGRAPHICS: Q36: Most of the respondents (80%) belong to a *Senior Management* (SM) position.

Table 7.18 shows the crossanalysis between the respondents' position group (SM/O) and its profession group (A/B). Groups A (Designers) and B (Accountants) have a similar representation of Directors, 30 and 28 respectively. However, representation of other positions is more random.

Table 7.18. [Q36|Group AB] Crossanalysis: Positions by profession

| | Director | Manager | Partner | Owner | Total Senior Management | Admin & Finance | Secretarial | General Staff | Human Resources | Total Other | Total |
|--------------|-----------|--------------|----------|----------|-------------------------|-----------------|-------------|---------------|-----------------|-------------|------------------------------------|
| Group A | 30 | 6 | 0 | 2 | 38 37% | 2 | 3 | 3 | 0 | 8 8% | 46 |
| Group B | 28 | 9 | 7 | 1 | 45 43% | 6 | 5 | 0 | 1 | 12 12% | 57 |
| Total | 58 | 15(1) | 7 | 3 | 83 | 8 | 8 | 3 | 1 | 20 | 103(2)⁴ 100% |

From the above:

Result S.7: DEMOGRAPHICS: [AB|Q36]: Designers in senior management positions (A|SM) represent 37% of the respondents. Designers in other positions (A|O) represent 8% of the respondents. Accountants in senior management positions (B|SM) represent 43% of the respondents. Accountants in other positions (B|O) represent 12% of the respondents.

³ Question 36 registered one non-response (XX-02), total number of responses is 104.

⁴ Questionnaires XX-01 and XX-02 cannot be taken into consideration as it is ignored to which Group (A or B) they belong, count is 103.

The 4 subgroups composed by the combination of profession group and position group (A|SM, A|O, B|SM and B|O) are used throughout the analysis section to distinguish characteristics between professions and positions.

Since there is a significant difference between the number of respondents grouped in the senior management group (83) compared with the number of respondents grouped by the other group (30), relative frequency percentages are used for comparison.

7.4.2 Office environment

7.4.2a Type of Building (Q1)

Data collected by question:

1 In what type of building is your office located?

☐ Adapted home / apartment unit

☐ Adapted warehouse or other non-office building

☐ Office building or building designed for the organisation's activities

Table 7.19 shows the frequency of responses to question 1. Responses are grouped in two groups. The first is adapted spaces and is composed by 'Adapted home/ Apartment unit' (Code 1) and 'Adapted warehouse or other non-office building' (Code 2). The second group is purposed designed spaces and is composed by the remanning code 4.

Table 7.19. Q1 Frequency table: type of building

| Code | Description | Frequency | Relative % | Group % |
|-------|--|---------------------|------------|--------------------------|
| 1 | Adapted home / apartment unit | 8 | 8% | Adapted space 25% |
| 2 | Adapted warehouse or other non-office building | 17 | 17% | |
| 3 | Office building or building designed for the organisation's activities | 76 | 75% | Purposed designed 75% |
| Total | | 101(4) ⁵ | 100% | 100% |

From the above:

Result S.8: **OFFICE ENVIRONMENT: Q01:** Most of the companies (75%) are hosted in purpose designed buildings. A quarter (25%) of the companies are hosted in adapted spaces, composed by 8% in adapted home/apartment units and 17% in adapted warehouse or other non-office building.

Crossanalysis between the city /suburb groups and the type of building (Q01), shows that all offices hosted in residential spaces (Code 1) are located in the suburbs. From the 17 offices located in non-office buildings, but not residential (Code 2) 7 of them are located in the city and 10 in the suburbs. From the 76 office buildings or buildings designed for the organisation's activities (Code 3) 41 are located in the city and 33 in the suburbs. Refer to Table [Q1|C/S] in Appendix 7c.

⁵ This question registered 4 non-responses (AC-55, BC-07, BC-59 and BS-08). The total number of responses taken into account is 101.

Result S.9: OFFICE ENVIRONMENT: [Q01|C/S]: All (100%) offices hosted in Adapted home / apartment unit are located in the Suburbs. The majority (59%) of the offices hosted in adapted warehouse or other non-office building are located in the Suburbs. The majority (55%) of the offices hosted in an office building or building designed for the organisation's activities are located in the City.

7.4.2b Environment satisfaction parameters (Q2)

Data collected by question:

| 2 | Evaluate the following parameters at your workplace: | | | | |
|---|--|----------------------------|----------------------------|----------------------------|---------------------------------|
| A) Temperature comfort | Poor | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Good |
| B) Ventilation comfort | Poor | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Good |
| M) Work space available on workstation | Poor | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Good |
| N) Overall space environment satisfaction | Poor | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Good |

In the above set of questions respondents were required to evaluate a series of ambient and space parameters using a 4 scale level of satisfaction. For reporting and analysis purposes the percentage of the frequency of the first two scales (1-2) is added up and grouped under 'Unsatisfactory' and the next two scales (3-4) under 'Satisfactory'. Figure 7.4 explains the syntax used to present the data collected from the 14 parameters (A to N) of question 2. Refer to Tables Q02(a-n) in Appendix 7c for frequency tables of each parameter.

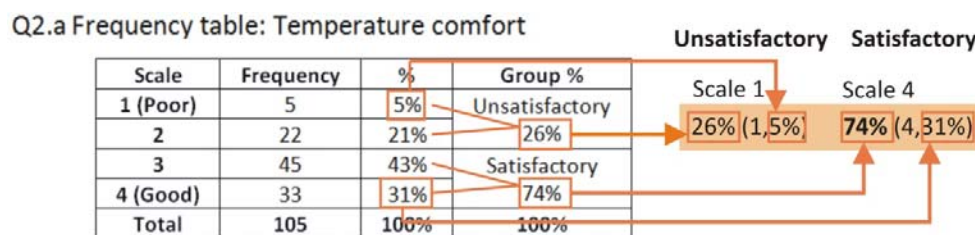


Figure 7.4. Unsatisfactory / Satisfactory syntax

Although not provided in the above, the percentages of Scale 2 and 3 can be easily obtained as follows:

- **Scale 2:** 26% - 5% = 21%
- **Scale 3:** 74% - 31% = 43%

Results using the above syntax are shown in Table 7.20. The highest percentage is bolded.

Table 7.20. Q02(a-n) Frequency table: Environment parameters summary

| Parameter | Unsatisfactory | Satisfactory |
|---|--------------------|--------------------|
| a) Temperature | 26% (1,5%) | 74% (4,31%) |
| b) Ventilation | 27% (1,7%) | 73% (4,35%) |
| c) Illumination | 18% (1,0%) | 82% (4,40%) |
| d) Background noise level | 34% (1,7%) | 66% (4,32%) |
| e) Frequency of distractions | 34% (1,6%) | 66% (4,26%) |
| f) Privacy at workstation | 36% (1,19%) | 66% (4,33%) |
| g) Voice privacy | 54% (1,29%) | 46% (4,22%) |
| h) General spatial arrangement | 16% (1,1%) | 84% (4,44%) |
| i) General furniture arrangement | 15% (1,2%) | 85% (4,42%) |
| j) General office size | 10% (1,2%) | 90% (4,54%) |
| k) General office storage space | 36% (1,14%) | 64% (4,36%) |
| l) Individual storage space | 31% (1,10%) | 69% (4,37%) |
| m) Workspace available on workstation | 14% (1,1%) | 86% (4,48%) |
| n) Overall space environment satisfaction | 12% (1,1%) | 88% (4,44%) |

From the above:

Result S.10: OFFICE ENVIRONMENT: Q02: Parameter '*j*) General office size' reported the highest number of respondents satisfied (90%). On the other hand, the majority of respondents (54%) were unsatisfied with '*g*) Voice privacy' which reported the lowest level of satisfaction in the study. Parameter '*j*) Office space' registered the highest percentage (90%) of satisfied respondents. Almost all respondents (88%) considered parameter '*n*) Overall space environment' satisfactory. Parameters '*a*) Temperature' and '*b*) Ventilation' ranked below '*c*) Illumination' satisfaction, but above '*d*) Noise level', '*e*) Distractions' and '*f*) Privacy'.

From the descriptive statistic summary in Appendix 7c, it can be seen that Parameter '*c*) Illumination' is the only variable in which the lowest scale (1) was not ticked by any of the respondents. All other parameters cover the full range of the scale (minimum =1, maximum =4).

Figure 7.5 shows the representative level of satisfaction of all respondents using the median of responses. Overall, the respondents' level of satisfaction with their office environment is good across most parameters.

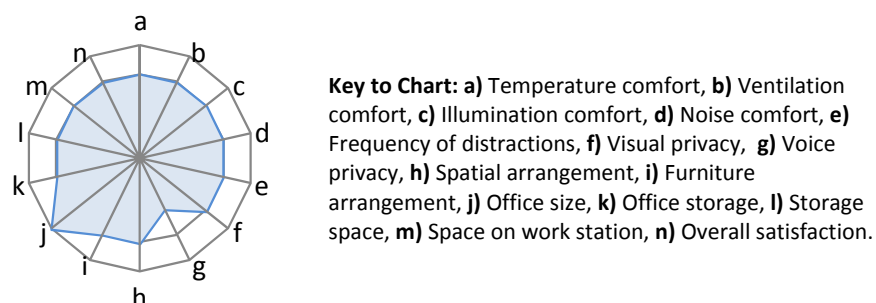


Figure 7.5. Median of responses to Q02(a-n)

The above figure highlights the poor level of satisfaction with parameter '*g*) Voice privacy at work station' and the high level of satisfaction with '*j*) General office size'.

Result S.11: OFFICE ENVIRONMENT: Q02: With the exception of '*g*) voice privacy', the level of office environment satisfaction is satisfactory across all respondents.

Figure 7.6 divides the office environment parameters in two columns. The right column clusters parameters 'a' to 'g' which measure environment comfort and privacy (East quadrant of radar chart shown in Figure 7.5, above). The left column clusters parameters 'h' to 'm' which measure spatial satisfaction (west quadrant of radar chart). In the middle is parameter 'n'. The lines linking the parameters show the correlation value of non-spurious relationship as previously described in the bivariate analysis section in Chapter 4. The thickness of the line indicates the strength of the association (the higher the association, the thicker the line).

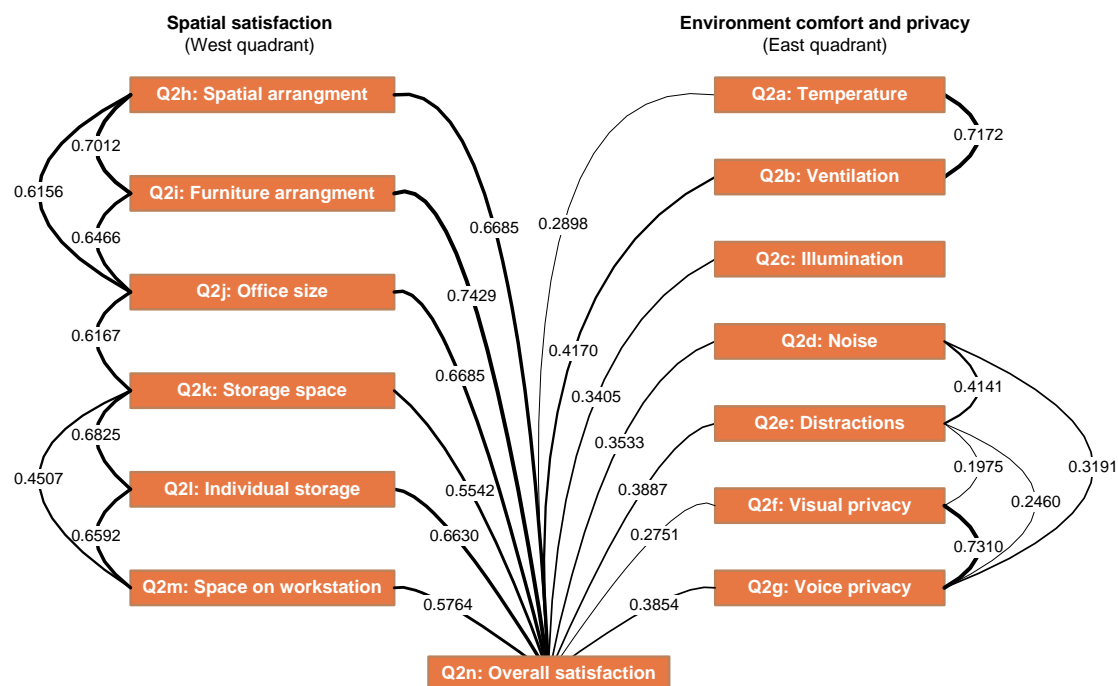


Figure 7.6. Environmental parameters correlation analysis

The above figure indicates that there is a stronger correlation between the spatial satisfaction parameters (left column) and the overall satisfaction parameter than with the latter and the environmental comfort and privacy parameters (right column). Likewise, the correlations between the parameters on the left column are generally higher than the ones between parameters of the right column. This could indicate that in the case of spatial parameters what seems to be good (or poor) in one parameter is similar in the other.

The highest correlation of 0.7429 in Figure 7.6 (and across the whole study) is between '*i*) Furniture arrangement' and '*n*) Overall satisfaction' parameters. The second highest correlation (0.7310) is between '*f*) Visual privacy' and '*g*) Voice privacy', both from the right column. Following in strength of correlation is '*a*) Temperature' and '*b*) Ventilation', both from the right column as well, with a coefficient of 0.7172.

From the above:

Result S.12: OFFICE ENVIRONMENT: Q02: Parameters '*i) Furniture arrangement*' and '*n) overall satisfaction*' have the highest correlation coefficient (0.7429) not only between environment parameters, but across all other variables.

Result S.13: OFFICE ENVIRONMENT: Q02: There is a high correlation (0.7310) between '*f) Visual privacy*' and '*g) Voice privacy*' parameters.

Result S.14: OFFICE ENVIRONMENT: Q02: '*a)Temperature*' and '*b)Ventilation*' parameters have a correlation coefficient of 0.7172.

Table 7.21 sorts the results shown in Table 7.20 from most satisfied to least satisfied (unsatisfied).

Table 7.21. Q02(a-n): Office environment parameters ranked by level of satisfaction

| Scale | Parameter |
|--|--|
| 90% ↑ Satisfied ↓ 64% Unsatisfied 54% | j) General office size |
| | n) Overall space environment satisfaction |
| | m) Workspace available on workstation |
| | i) General furniture arrangement |
| | h) General spatial arrangement |
| | c) Illumination |
| | a) Temperature |
| | b) Ventilation |
| | l) Individual storage space |
| | d) Noise level / e) Distractions / f) Visual privacy |
| | k) General office storage space |
| | g) Voice privacy |

From the above, it can be seen that spatial parameters (h-m) are higher in the table than environment and privacy parameters (a-g).

Result S.15: OFFICE ENVIRONMENT: Q02: Overall, spatial parameters (h-m) ranked better than environment comfort and privacy parameters (a-g).

Table 7.22 is a summary of the crossanalysis between question 2 (office environment satisfaction) and question 1 (type of building) and question 1 (office layout), based on crossanalysis Tables [Q01|Q02(a-n)] and tables [Q03|Q02(a-n)] in Appendix 7c. This analysis aims to identify which environment, if any, ranked better than the other.

Table 7.22. [Q01|Q03|Q02] Crossanalysis summary: Office environment by Type of building and Layout

| Parameter | Type of Building Q01 Q02(a-n) | | Layout Q03 Q02(a-n) | |
|---|----------------------------------|---------|------------------------|------|
| | Adapted | Purpose | Enclosed | Open |
| a) Temperature comfort | ? | ? | ✓(10%) | |
| b) Ventilation comfort | ✓(24%) | | ? | ? |
| c) Illumination comfort | | ✓(14%) | ? | ? |
| d) Background noise | ? | ? | ? | ? |
| e) Frequency of distractions | ✓(10%) | | ? | ? |
| f) Visual privacy at your workstation | ? | ? | ✓(39%) | x |
| g) Voice privacy at workstation | ?* | ?* | ✓(44%) | x |
| h) General spatial arrangement | ✓(10%) | | ✓(11%) | |
| i) General furniture arrangement | ? | ? | ? | ? |
| j) General office size | ? | ? | ? | ? |
| k) General office storage space | ? | ? | ? | ? |
| l) Individual storage space | ? | ? | ? | ? |
| m) Work space available on workstation | ? | ? | ? | ? |
| n) Overall space environment satisfaction | ? | ? | ? | ? |
| Total of ✓'s | 3 | 1 | 4 | - |

In the above table a “✓” (tick) indicates which type of building (adapted/purpose) and which type of layout (enclosed/open) ranked better on each of the office environment parameters. Next to the tick is the difference in percentage by which the parameter was more satisfactory than the other. Inconclusive results, those with a difference smaller than 10%, are indicated with a “?” (question mark). Since the majority of respondents ranked most of the parameters across both building types and layout as satisfactory, the tick denotes which type ranked better than the other, but do not imply that the un-ticked is unsatisfactory. However, the “x” (cross) on ‘f) visual privacy’ and ‘g) voice privacy’ for the open layout do indicates unsatisfactory results. In the case of *voice privacy* both building types (Adapted/purpose) were similarly unsatisfactory and marked with a ‘?’* (the asterisk next to the question mark denotes inconclusive dissatisfaction in both cases).

From the above:

Result S.16: OFFICE ENVIRONMENT: [Q03|Q02a]: Enclosed layouts ranked better (by 10%) than open layouts at temperature comfort.

Result S.17: OFFICE ENVIRONMENT: [Q01|Q02b]: Adapted buildings ranked better (by 24%) than purpose designed buildings at ventilation comfort.

Result S.18: OFFICE ENVIRONMENT: [Q01|Q02c]: Purpose designed buildings ranked better (by 14%) than adapted buildings at illumination.

Result S.19: OFFICE ENVIRONMENT: [Q01|Q02e]: Adapted buildings ranked better (by 10%) than purpose designed buildings at frequency of distractions.

Result S.20: OFFICE ENVIRONMENT: [Q03|Q02f]: Enclosed layouts ranked better (by 39%) than open layouts at visual privacy.

Result S.21: OFFICE ENVIRONMENT: [Q03|Q02g]: Enclosed layouts ranked better (by 44%) than open layouts at voice privacy.

Result S.22: OFFICE ENVIRONMENT: [Q01|Q02h]: Adapted buildings ranked better (by 10%) than purpose designed buildings at spatial arrangement.

Result S.23: OFFICE ENVIRONMENT: [Q03|Q02h]: Enclosed layouts ranked better (by 11%) than open layouts at spatial arrangement.

Result S.24: OFFICE ENVIRONMENT: [Q03|Q02a] [Q01|Q02b] [Q01|Q02c] [Q01|Q02e] [Q03|Q02f] [Q03|Q02g] [Q01|Q02h] [Q03|Q02h]: Overall, adapted buildings and enclosed layouts outperformed purpose designed buildings and open layouts.

Result S.25: OFFICE ENVIRONMENT: [Q03|Q02f] [Q03|Q02g]: Visual and voice privacy ranked better in enclosed layouts than open layouts.

7.4.2c Office layout (Q3)

Data collected by question:

3 Which layout best describes your workplace?

☐ **Enclosed:** Consists of individual rooms (full height walls) with a corridor for access

☐ **Open-plan:** No internal walls or fixed partitions, space is divided by workstations

As seen on question 3, only two options were offered: 'Enclosed' and 'Open-plan'. However, a total of 8 respondents provided a third option based on the combination of these two. This third option was adopted for analysis. A discussion on this decision and its possible consequences is offered in Appendix 7b. The crossanalysis previously discussed in Table 7.22, does not take into consideration option 3, thus the total number of respondents analysed in the previous cross analysis [Q01|Q03|Q02] is 97 (105-8).

Table 7.23 shows the frequency of responses for question 3.

Table 7.23. Q03 Frequency table: Office layout

| Code | Description | Frequency | % |
|-------|-------------------------------------|-----------|------|
| 1 | Enclosed | 40 | 38% |
| 2 | Open-plan | 57 | 54% |
| 3 | Combination: Enclosed and Open-plan | 8 | 8% |
| Total | | 105 | 100% |

From the above:

Result S.26: OFFICE ENVIRONMENT: Q03: Open plan is the most typical (54%) office layout.

Table 7.24 is a cross analysis between office layout and type of building.

Table 7.24. Crossanalysis [Q03|Q01]: Office layout and Type of building

| Office layout | Adapted residential | | Adapted non-residential | | Purpose designed | | Total |
|---------------|---------------------|-------------|-------------------------|-------------|------------------|-------------|---------------|
| | Freq. | % | Freq. | % | Freq. | % | |
| Enclosed | 6 | 75% | 1 | 6% | 31 | 41% | 38(2) |
| Open-plan | 2 | 25% | 15 | 88% | 38 | 50% | 55(2) |
| Combination | - | - | 1 | 6% | 7 | 9% | 8 |
| Total | 8 | 100% | 17 | 100% | 76 | 100% | 101(4) |

The above table shows that most (75%) of the adapted residential buildings have enclosed layouts, which could be an inherited consequence of the structure of its original function (divided rooms). Most (88%) of the adapted non-residential buildings are open-plan; most of these spaces could have been old warehouses, factories, etc. One of the respondents that selected this option handwrote 'old warehouse' at the margin of the questionnaire. In the case of purpose designed buildings half are open-plan.

From the above:

Result S.27: OFFICE ENVIRONMENT: [Q03|Q01]: Most of the offices (75%) hosted in adapted residential buildings have enclosed layouts.

Result S.28: OFFICE ENVIRONMENT: [Q03|Q01]: Most of the offices (88%) hosted in adapted non-residential buildings have open-plan layouts.

Result S.29: OFFICE ENVIRONMENT: [Q03|Q01]: Half of the offices (50%) hosted in purpose designed buildings have open-plan layouts.

Table 7.25 is a crossanalysis between office layout and office size.

Table 7.25. Crossanalysis [Q03|Q33]: Office layout by size.

| Office layout | 1-10 | | 11+ | | Total |
|---------------|-----------|-------------|-----------|-------------|------------|
| | Freq. | % | Freq. | % | |
| Enclosed | 29 | 48% | 11 | 24% | 40 |
| Open-plan | 27 | 45% | 30 | 67% | 57 |
| Combination | 4 | 7% | 4 | 9% | 8 |
| Total | 60 | 100% | 45 | 100% | 105 |

From the above:

Result S.30: OFFICE ENVIRONMENT: [Q03|Q33]: The majority of organisations (67%) with 11 or more employees have open-plan layouts. Whereas, less than half (45%) organisations with 1-10 employees have open-plan layouts.

Table 7.26 is a crossanalysis between office layout and Profession group.

Table 7.26. Crossanalysis [Q03|A/B]: Office layout by Profession group.

| Office layout | Group A | | Group B | | Total |
|---------------|---------|------|---------|------|--------|
| | Freq. | % | Freq. | % | |
| Enclosed | 11 | 24% | 29 | 51% | 40 |
| Open-plan | 34 | 74% | 21 | 37% | 55(2) |
| Combination | 1 | 2% | 7 | 12% | 8 |
| Total | 46 | 100% | 57 | 100% | 103(2) |

Result S.31: OFFICE ENVIRONMENT: [Q03|A/B]: Most of the Designers (74%) have an open-plan layout. On the other hand, the majority of Accountants (51%) have an enclosed layout.

7.4.3 Work Habits

7.4.3a Hours work per week (Q13)

Data collected by question:

| | | | |
|----|--|--|----------------|
| 13 | On average, how many hours do you work <u>per week</u> ? | | Hrs / per week |
|----|--|--|----------------|

Across all respondents the median of working hours per week is 45 and the mode is 40 hours per week. The minimum of working hours per week registered is 7.5, equivalent to one day per week. The maximum working hours registered is 80 hours per week, which represents an average of 16 hours per day (based on a five day working week). Only 4% of respondents worked the standard working week of 37.5 hrs. Most respondents (85%) worked overtime (beyond 37.5 hours per week). The range 37.6 to 40 hrs per week groups a third (33%) of the respondents. The second highest range is 46 to 50 hours per week which accounts for 27% of respondents. Refer to Table 7.27.

Table 7.27. [Q13|A/B] Crossanalysis: Frequency table of Working hours per week by Profession group

| Hrs. Per Week | Group A | Group B | Total (A+B) | Group by hpw |
|--------------------|-----------|-----------|---------------|--|
| 7.5 | 1 | - | 1 | Casual / Part time (<37.5 hpw) 11 (11%) |
| 7.6 to 15 | 1 | - | 1 | |
| 16 to 20 | - | - | - | |
| 21 to 37.4 | 4 | 5 | 9 | |
| 37.5 (Standard) | - | 4 | 4 | Standard working hrs 4 (4%) |
| 37.6 to 40 | 14 | 20 | 34 | Overtime (>37.5 hpw) 88 (85%) |
| 41 to 45 | 2 | 4 | 6 | |
| 46 to 50 | 13 | 15 | 28 | |
| 51 to 55 | 2 | 1 | 3 | |
| 55 to 60 | 8 | 3 | 11 | |
| 61 to 65 | - | 1 | 1 | |
| 66 to 70 | 1 | 1 | 2 | |
| 71 to 75 | - | 2 | 2 | |
| 76 to 80 | - | 1 | 1 | |
| Total | 46 | 57 | 103(2) | 103(2)⁶ |

The above table shows that there are 6 respondents from group A and 5 respondents from group B working part-time (less than 37.5 hours per week). There are no respondents from group A, and only 4 from group B working the standard working hours per week.

Result S.32: WORK HABITS: [Q13|A/B]: Most of the respondents (85%) work overtime (37.5+ h.p.w). Only 4% of respondents work a standard week (37.5 h.p.w). Part-time or casual employees represented 11% of the respondents.

The above crossanalysis shows that there are differences in the amount of working hours per week by profession. For Group A (Designers) the minimum working hours per week is 7.5 and the maximum is 70 hours per week (66-70 range). Whereas for Group B (Accountants) the minimum is 25 hours per week (21-37.4 range) and the maximum 80 hours per week (76-80 range). The median for the former is 49 (mode 50) and for the latter 40 (mode 40) hours per week. This indicates that respondents from Group A work on average more hours per week than Group B, but some respondents belonging to Group B work more hours per week than the highest respondent of Group A.

Result S.33: WORK HABITS: [Q13|A/B]: On average *Designers* work more hours per week than *Accountants*. However, some *Accountants* (3) work more hours per week than the *Designer* working the most hours.

Table 7.28 shows a crossanalysis of working hours per week by profession and position groups [Q13|A/B|SM/O] and indicates the percentage of respondent in each subgroup that work less than 37.6 hours per week, from 37.6 to 40, and more than 40 hours per week.

⁶ The working hours of respondents XX-01 (40) and XX-02 (38) cannot be taken into consideration for the analysis as it is unknown to which profession (group A or B) they belong.

Table 7.28. [Q13|A/B|SM/O] Crossanalysis: Working hours per week by Profession and Position

| Scale | Group A | | Group B | |
|-------------------|---------|------|---------|------|
| | A SM | A O | B SM | B O |
| Less than 37.6 | 11% | 25% | 11% | 33% |
| 37.6 to 40 | 24% | 63% | 31% | 50% |
| More than 40 | 66% | 13% | 58% | 17% |
| Total (%) | 100% | 100% | 100% | 100% |
| Total (Frequency) | 38 | 8 | 45 | 12 |

The ‘Total (Frequency)’ row of the above table highlights the difference between the number of respondents amongst Senior Management (SM) and Other (O) positions across groups A and B as previously discussed in Table 7.18. Thus, percentages are used to overcome such disparity in representation and be able to compare and detect associations, if any, between variables.

As per Table 7.28, the distribution of sub-group A:SM and sub-group B:SM is similar: they share the same percentage (11%) of respondents working less than 37.6 hours per week and the majority (66% for A:SM and 58% for B:SM) work more than 40 hrs per week. Likewise, the distribution of subgroup A:O and B:O is also similar: the bulk of the respondents in these sub-groups (63% for group A:O and 50% for B:O) work 37.6 to 40 hours per week. Given that position subgroups (SM/O) are similar across profession groups (A/B) and systematically differ between professions, suggest that it is the respondents’ position (SM or O) rather than the group (A or B) that influences the amount of hours worked per week.

Result S.34: WORK HABITS: [Q13|A/B|SM/O]: The respondent’s position (SM/O) influences the amount of hours worked per week more than the profession (A/B) they belong to.

Result S.35: WORK HABITS: [Q13|A/B|SM/O]: Respondents grouped under Senior Management are likely to work more hours per week than respondents in Other positions.

7.4.3b Taking work home (Q14)

Data collected by question:

14 Do you take work home?

Never ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ Everyday

☐ 5 I work from home (Teleworker)

Table 7.29 shows the frequency of responses for question 14. Responses are grouped into ‘never’ (scale 1), ‘occasionally’ (scale 2 and 3) and ‘everyday’ (scale 4).

Table 7.29. Q14 Frequency table: Respondents taking work home

| Scale | Frequency | % | Group % |
|--------------------|-----------|------|---------------------|
| 1 (Never) | 25 | 24% | Never 24% |
| 2 | 42 | 40% | Occasionally 63% |
| 3 | 24 | 23% | |
| 4 (Everyday) | 10 | 9% | Every day 9% |
| 5 (work from home) | 4 | 4% | 4% |
| Total | 105 | 100% | 100% |

From the above:

Result S.36: WORK HABITS: Q14: The majority of respondents (63%) take work home occasionally. Almost a quarter of respondents (24%) never take work home, whilst 9% take work home every day.

The four respondents that registered option 5 “*I work from home (Teleworker)*”, work from home, but are not teleworkers. This is further explained in section 7.4.6 *Alternative Ways of Working (AWW)*.

The crossanalysis of the respondent’s frequency of taking work home by profession group and position subgroup [Q14|A/B|SM/O] shown in Table 7.30 indicates a distinctive similarity across profession groups in the percentage of respondents taking work home, especially in ranges 2, 3 and 4 for senior management and ranges 1, 3 and 4 for other profession group.

Table 7.30. Crossanalysis [Q14|A/B|SM/O]: Frequency of taking work home by Profession group and Position subgroup

| Scale | | Group A | | | | Group B | | | |
|--------------------|--------------|---------|-----|------|-----|---------|-----|------|-----|
| | | A SM | | A O | | B SM | | B O | |
| 1 (Never) | | 18% | | 25% | | 27% | | 25% | |
| 2 | Occasionally | 37% | 63% | 50% | 63% | 36% | 60% | 67% | 75% |
| 3 | | 26% | | 13% | | 24% | | 8% | |
| 4 (Every day) | | 13% | | 0% | | 11% | | 0% | |
| 5 (Work from home) | | 5% | | 13% | | 2% | | 0% | |
| Total (%) | | 100% | | 100% | | 100% | | 100% | |
| Total (Frequency) | | 38 | | 8 | | 45 | | 12 | |

Result S.37: WORK HABITS: [Q14|A/B|SM/O]: The majority of respondents (60% to 75%, depending on the profession and position subgroup) take work home occasionally.

As per the previous crossanalysis in Table 7.28, the above table suggests that position rather than profession seems to have a greater influence in increasing the frequency of taking work home. Senior management position is the only group across both professions to take work home every day.

From the above:

Result S.38: WORK HABITS: [Q14|A/B|SM/O]: The frequency by which respondents take work home is influenced more by their position than by their profession.

Result S.39: WORK HABITS: [Q14|A/B|SM/O]: Senior management respondents are more likely to take work home than respondents in other positions.

7.4.3c Working on weekends (Q15)

Data collected by question:

15 Do you work on weekends?

Never ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ Every weekend

Table 7.31 shows the frequency of responses to Question 15. Responses on scale 2 and 3 are grouped on 'occasionally' group.

Table 7.31. Q15 Frequency table: respondents that work on weekends

| Scale | Frequency | % | Group % |
|--------------------------|------------|-------------|----------------------------|
| 1 (Never) | 28 | 27% | Never 27% |
| 2 | 50 | 48% | Occasionally 68% |
| 3 | 21 | 20% | |
| 4 (Every Weekend) | 6 | 5% | Every weekend 5% |
| Total | 105 | 100% | 100% |

From the above:

Result S.40: WORK HABITS: Q15: The majority of respondents (68%) occasionally work on weekends. Over a quarter of respondents (27%) never work on weekends, whilst 5% work every weekend.

Table 7.32 is a crossanalysis of the frequency of working on weekends by profession and position groups [Q15|A/B|SM/O].

Table 7.32. [Q15|A/B|SM/O] Crossanalysis: Frequency of working on weekends by Profession and Position groups

| Scale | | Group A | | | | Group B | | | |
|-------------------|--------------|---------|-----|------|-----|---------|-----|------|-----|
| | | A SM | | A O | | B SM | | B O | |
| 1 (Never) | | 18% | | 50% | | 16% | | 75% | |
| 2 | Occasionally | 55% | 76% | 38% | 51% | 49% | 76% | 25% | 25% |
| 3 | | 21% | | 13% | | 27% | | - | |
| 4 (Every weekend) | | 5% | | - | | 9% | | - | |
| Total (%) | | 100% | | 100% | | 100% | | 100% | |
| Total (Frequency) | | 38 | | 8 | | 45 | | 12 | |

From the above, subgroups A:SM and B:SM have a similar percentage distribution which contrasts with subgroups A:O and B:O. This is consistent with the previous two crossanalysis in that position, rather than the profession, determines the frequency by which respondents take work home.

Result S.41: WORK HABITS: [Q15|A/B|SM/O]: Senior management respondents are more likely to work on weekends than respondents in other positions.

The consistency of results obtained through the crossanalysis of Table 7.28, Table 7.30, and Table 7.32 suggests that:

Result S.42: WORK HABITS: [Q13|A/B|SM/O] [Q14|A/B|SM/O] [Q15|A/B|SM/O]: Overall, senior management respondents are more likely to work longer hours and more frequently take work home and work on weekends than respondents in other positions.

7.4.3d Work / life balance (Q16)

Data collected by question:

| | | | |
|----|--|--------------------------------|-------------------------------|
| 16 | Are you happy with your work / life balance? | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No |
|----|--|--------------------------------|-------------------------------|

Table 7.33 shows the frequency of responses to Question 15.

Table 7.33. Q16 Frequency table: Satisfaction with work/life balance

| Code | Description | Frequency | % |
|-------|-------------|-----------|------|
| 1 | Yes | 76 | 72% |
| 2 | No | 29 | 28% |
| Total | | 105 | 100% |

From the above:

Result S.43: WORK HABITS: Q16: Most respondents (72%) are happy with their work/life balance.

Figure 7.7 plots the respondents' work/life balance satisfaction grouped by their working hours per week as per Table [Q13|Q16] in Appendix 7c. The first three ranges ('7.5' – '16 to 20') and the last four ('61 to 65' – '76 to 80') are not included in the analysis (shaded area) since their low respondent representation (just one respondent per range) produce misleading result. Previous Table 7.27, shows the frequency of respondents by number of working hours per week.

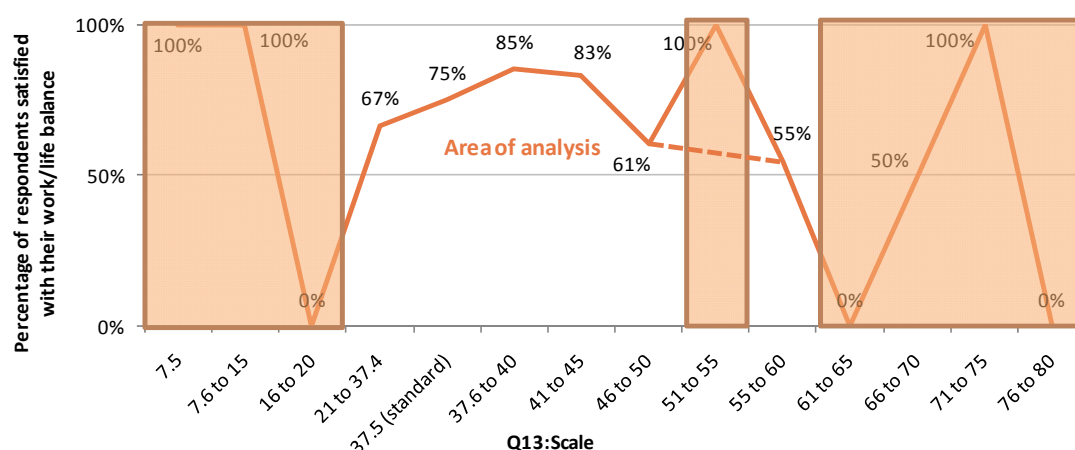


Figure 7.7. [Q13|Q16] Crossanalysis: Work/life balance satisfaction based on working hours per week

In the above figure the percentage of respondents satisfied with their work life balance peaks (85%) at the 37.6 to 40 hours per week range. It stands out that the percentage of satisfied respondents in the next range (41 to 45) is higher than the other two lower ranges at the left of the peak point, which includes the standard 37.5 per week range. A peak is produced (100% satisfaction) at the 9th range (shaded), however it is considered that this could be a false peak product of the low count of respondents (3) in this range. All the three respondents in this range are happy with their life balance, but a bigger count might have balanced the responses. The dashed lines between the 8th and the 10th range suggest the expected tendency if the count of range 9 was higher. At the 10th range (55 to 60) the majority of respondents (55%) are still satisfied with their work/life balance. From then onwards the low representation of respondents prevents drawing further results. It can only be said that the two respondents working 75 working hours per week (13th range) are still satisfied with their work/life balance, but the only respondent working up to 80 hrs a week (last range) is not.

From the above:

Result S.44: WORK HABITS: [Q13|Q16]: The highest percentage of respondents (85%) that is satisfied with their work/life balance is in the 37.6 to 40 working hours per week range.

Result S.45: WORK HABITS: [Q13|Q16]: The majority of respondents (55%) working 55 to 60 hours per week are still happy with their work/life balance.

Result S.46: WORK HABITS: [Q13|Q16]: The two respondents working 71 to 75 hours per week are satisfied with their work/life balance.

Result S.47: WORK HABITS: [Q13|Q16]: The only respondent working up to 80 hours per week (the highest range) is unsatisfied with his work/life balance.

Result S.48: WORK HABITS: [Q13|Q16]: The percentage of respondents (75%) that work the standard working hours (37.5) per week and are satisfied with their work/life balance is lower than the percentage of respondents (83%) working up to 45 hours per week.

Figure 7.8 plots the respondents' work/life balance satisfaction grouped by the frequency of taking work home. This chart is based on Table [Q14|Q16] in Appendix 7c.

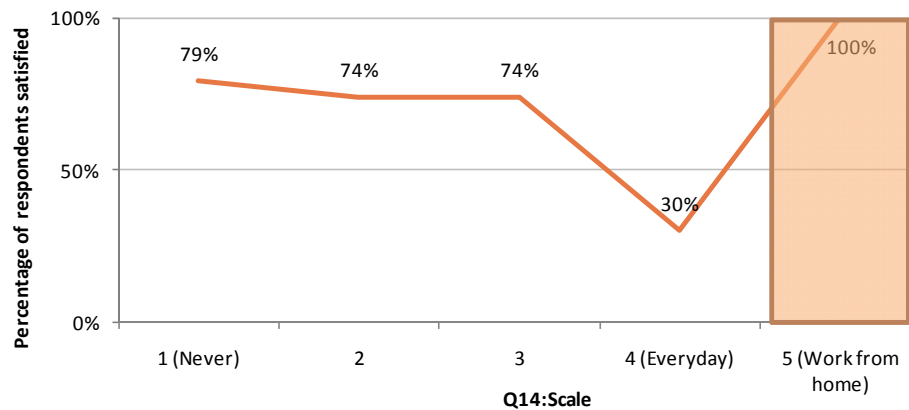


Figure 7.8. Crossanalysis [Q14|Q16]: Work/life balance satisfaction by frequency of taking work home

The above figure shows that most of the respondents (79%) that never take work home (Scale 1) are happy with their work/life balance. The percentage of satisfaction drops by 5% as respondents occasionally take work home (Scales 2 and 3). However, taking work home every day (Scale 4) significantly affects the level of work/life balance satisfaction, with only 30% of the respondents in this scale being happy with their work/life balance.

All respondents (4) that work from home (scale 5, shaded area in the above figure) are satisfied with their work/life balance.

Result S.49: WORK HABITS: [Q14|Q16]: Most of the respondents (79%) that never take work home are satisfied with their work/life balance. The percentage of satisfaction decreases to 74% as respondents occasionally take work home. However, taking work home every day considerably lowers the percentage of respondents (30%) that are happy with their work/life balance.

Result S.50: WORK HABITS: [Q14|Q16]: All of the respondents (4) that work from home are satisfied with their work/life balance.

Figure 7.9 plots the respondents' work/life balance satisfaction grouped by their frequency of working on weekends. This chart is based on Table [Q15|Q16] in Appendix 7c.

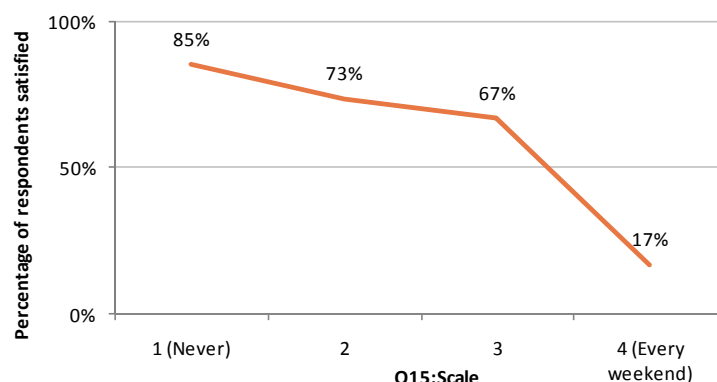


Figure 7.9. [Q15|Q16] Crossanalysis: Work/life balance satisfaction by frequency of working on weekends.

The above figure shows that most of the respondents (85%) that never work on weekends are happy with their work/life balance. In contrast to the previous crossanalysis Figure 7.8, the percentage of respondents that were happy with their work/life balance decreased more (by 12%) between scale 1 (85%) and scale 2 (73%) than in the previous variable (taking work home). There is also a difference (of 6%) in the percentage of satisfied respondents between scales 2 and 3. Moreover, the percentage of satisfaction (17%) with their *life/work* balance for respondents that work every weekend (scale 4) is also lower than in the previous variable.

Result S.51: WORK HABITS: [Q15|Q16]: Most of the respondents (85%) that never work on weekends were satisfied with their work/life balance. This percentage declined as the frequency of working on weekends increased (Scale 2=73%, Scale 3=67%). Working every weekend considerably lowers the percentage (17%) of respondents that are happy with their work/life balance.

Result S.52: WORK HABITS: [Q14|Q16] [Q15|Q16]: Working on weekends affects the respondents' work/life balance satisfaction more than taking work home.

Table 7.34 is a crossanalysis of *work/life balance satisfaction* by *Position* group.

Table 7.34. [Q16|SM/O] Crossanalysis: Work/life balance satisfaction and Position sub-group.

| Scale | Group A | | | | Group B | | | |
|--------------------|---------|------|-----|------|---------|------|-----|------|
| | A SM | | A O | | B SM | | B O | |
| 1 Yes (Satisfied) | 27 | 71% | 6 | 75% | 30 | 67% | 11 | 92% |
| 2 No (Unsatisfied) | 11 | 29% | 2 | 25% | 15 | 33% | 1 | 8% |
| Total | 38 | 100% | 8 | 100% | 45 | 100% | 12 | 100% |

As per the above table, the percentage of respondents satisfied in the A|SM and B|SM sub-groups is below A|O and B|O sub-groups. In the case of the O sub-group (both Professions) the percentages of respondents satisfied (A|O=75%, B|O=92%) are both higher than the percentage obtained across all respondents (72%), refer to Table 7.33.

Result S.53: WORK HABITS: [Q16|SM/O]: The percentage of respondents that are happy with their work/life balance (A|O=75%, B|O=92%) in the other position group is higher than the senior management group (A|SM=71%, B|SM=67%) and above the percentage obtained across all respondents (72%).

7.4.3e Workstation dependency (Q4)

Data collected by question:

4

On average, you are at your desk / workstation:

Rarely
1 ☐
2 ☐
3 ☐
4 ☐
Most of the time

As shown in Table 7.35 the majority of respondents (58%) are most of the time at their workstation. Responses are grouped into 'rarely at workstation', scales 1 and 2 and 'commonly at workstation', scales 3 and 4.

Table 7.35. Q04 Frequency table: Time spent at workstation

| Scale | Frequency | % | Group % |
|----------------------|------------|-------------|---------------------------------------|
| 1 (Rarely) | - | - | Rarely at workstation 6% |
| 2 | 6 | 6% | |
| 3 | 38 | 36% | Commonly at workstation 94% |
| 4 (most of the time) | 61 | 58% | |
| Total | 105 | 100% | 100% |

The above table shows that almost all of the respondents (94%) are commonly at their workstation. There are no respondents on Scale 1 (rarely).

From the above:

Result S.54: WORK HABITS: Q04: Almost all (94%) of the respondents are commonly at their workstation. The majority (58%) are most of the time (scale 4) at their workstation.

Result S.55: WORK HABITS: Q04: There are no respondents that are rarely at their workstation (scale 1).

The distribution of respondents in this question (94% in the last two scales with 58% in scale 4) renders meaningless a crossanalysis by profession and position as the ones previously done in Questions 13 to 16. Instead, the 6 respondents with the lowest workstation dependency (scale 2 of the above table) are analysed based on the responses given on other questions that could affect their dependency on their workstation. Table [Q04=1|A/B|SM/O|Q36|Q13|Q05], refer to Appendix 7c, looks into the profession group, position group, detailed position (before SM/O clustering), working hours per week and working modes of these respondents.

From the above:

Result S.56: WORK HABITS: [Q04=1|A/B|SM/O|Q36|Q13|Q05]: The majority (4 out of 6 respondents) with low workstation dependency are accountants, all belong to the senior management group, but vary in their detailed position (3 directors, 2 managers, and 1 partner). Half work 50 hours per week. Half of them spend most of their time doing individual work, two doing face-to-face collaboration and one spends 100% of her time at the office building relationships.

7.4.3f Working modes (Q5)

Data collected by question:

5 **Approximate percentage of time you spend in the following working modes:** (Should add to 100%)

1 % Individual work, and quiet thinking 2 % Face-to-face collaboration 3 % Building relationships, and socialising

Table 7.36 shows the frequency of responses of question 5. The frequency and percentage of respondents are grouped in increments of 10% of time spent in each of the three working modes shown above.

Table 7.36. Q05 Frequency table: Time spent in various working modes

| Range % of time | Individual work and quiet thinking | | Face-to-face Collaboration | | Building relationships and socialising | |
|--------------------|---------------------------------------|-------------|-------------------------------|-------------|---|-------------|
| | Freq. | % | Freq. | % | Freq. | % |
| 90-100 | 10 | 10% | - | - | 1 | 1% |
| 80-89 | 25 | 24% | - | - | - | - |
| 70-79 | 15 | 14% | - | - | - | - |
| 60-69 | 18 | 17% | 3 | 3% | 3 | 3% |
| 50-59 | 12 | 11% | 7 | 7% | 2 | 2% |
| 40-49 | 3 | 3% | 10 | 10% | 5 | 5% |
| 30-39 | 11 | 10% | 16 | 15% | 6 | 6% |
| 20-29 | 8 | 8% | 30 | 29% | 21 | 20% |
| 10-19 | 2 | 2% | 30 | 29% | 28 | 27% |
| 1-9 | - | - | 7 | 7% | 31 | 30% |
| 0 | 1 | 1% | 2 | 2% | 8 | 8% |
| Total | 105 | 100% | 105 | 100% | 105 | 100% |

From the above:

Result S.57: WORK HABITS: Q05: The range '80-89%' of working time accumulates the highest percentage of respondents (24%) working in individual work and quiet thinking mode. Most of the respondents (65%) spend 60% or more of their time working in this mode. A tenth (10%) of respondents work in this mode 90-100% of their time.

Result S.58: WORK HABITS: Q05: Most of the respondents (58%) spend between 10% to 29% of their time (two ranges) working in face-to-face collaboration mode. Few respondents (3%) spend 60-69% of their time in this mode. None of the respondents spend more than 69% of their time in this working mode.

Result S.59: WORK HABITS: Q05: The highest percentage of respondents (30%) working in building relationships and socialising mode concentrated in a single range happens in range 1-9%. The majority of respondents (57%) work in this mode up to 19% of their time. This working mode has the highest percentage (8%) of respondents not working in this mode. However, one respondent works in this mode 100% of the time.

The median for all respondents is 62.5% for individual work and quiet thinking, 20% for Face-to-face collaboration and 10% for Building relationships and socialising, refer to *descriptive statistics summary* in Appendix 7c. Since the sum of the three working modes is 92.5%, the percentages were proportionally adjusted to add up to 100%. Figure 7.7 shows the representative working mode chart across all respondents based on the adjusted figures.

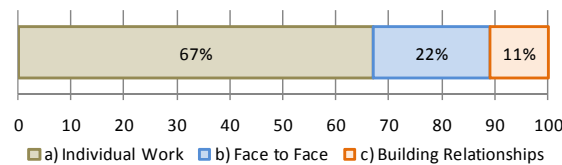


Figure 7.10. Representative percentage of time spend in working modes

Result S.60: WORK HABITS: Q05: The representative percentage of time spend across all respondents in individual work and quite thinking is 67%, face-to-face collaboration 22% and building relationships and socialising 11%.

Table 7.37 is a summary of the crossanalysis of working modes by *Profession* and *Position* done on Table [Q05a|A/B|SM/O], Table [Q05b|A/B|SM/O] and Table [Q05c|A/B|SM/O] in Appendix 7c. For analysis and presentation purposes no frequency of responses are shown (just percentages) and ranges have been merged to 20%.

Table 7.37. Crossanalysis [Q05|A/B|SM/O]: Percentage of time spend in various working modes by Profession and Position

| Range | Individual work and quiet thinking | | | | Face-to-face collaboration | | | | Building relationships and socialising | | | |
|--------|------------------------------------|------|---------|------|----------------------------|------|---------|------|--|------|---------|------|
| | Group A | | Group B | | Group A | | Group B | | Group A | | Group B | |
| | A SM | A O | B SM | B O | A SM | A O | B SM | B O | A SM | A O | B SM | B O |
| 80-100 | 40% | 25% | 31% | 25% | - | - | - | - | 3% | - | - | - |
| 60-79 | 28% | 50% | 29% | 42% | 3% | - | 4% | - | 8% | - | - | - |
| 40-59 | 10% | 25% | 11% | 25% | 8% | - | 24% | 25% | 5% | - | 9% | 8% |
| 20-39 | 16% | | 27% | 8% | 40% | 62% | 44% | 42% | 18% | 50% | 27% | 25% |
| 1-19 | 3% | - | 2% | - | 46% | 38% | 28% | 25% | 61% | 50% | 57% | 50% |
| 0 | 3% | - | - | - | 3% | - | - | 8% | 5% | - | 7% | 17% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

From the above:

Result S.61: WORK HABITS: [Q05|A/B]: Designers (A|SM=40%, A|O=25%) spend more time than accountants (B|SM=31%, B|O=25%) doing individual work and quiet thinking in the 80-100% range.

Result S.62: WORK HABITS: [Q05|SM/O]: Senior management (A|SM=40%, B|SM=31%) spends more time than other (A|O=25%, B|O=25) positions doing individual work and quiet thinking in the 80-100% range.

Result S.63: WORK HABITS: [Q05|SM/O]: Senior management across professions (A|SM=3%, B|SM=4%) is the only sub-group represented in the 60-79% range of time working in face-to-face collaboration mode. This range is the highest reported for this working mode.

Result S.64: WORK HABITS: [Q05|A/B]: Designers are more likely to spend more time building relationships and socialising than accountants.

Result S.65: WORK HABITS: [Q05|A/B|SM/O]: Designers at senior management level (A|SM) are the only sub-group represented spending over 60% of time building relationships and socialising.

7.4.3g Preferred place for work related interaction (Q6)

Data collected by question:

6 Which is the place where most productive work related interaction is done?

- ☐ 1 Meeting rooms
- ☐ 2 Each other's workstation / office
- ☐ 3 Informal environment within the office (Cafeteria / kitchen, etc)
- ☐ 4 Somewhere outside the office (Coffee shop, etc)

Table 7.38 shows the frequency of responses to question 6. Responses to codes 1, 2 and 3 are grouped into places 'inside the office', code 4 is grouped in places 'outside the office'.

Table 7.38. Q06 Frequency table: Preferred place for work related interaction

| Code | Description | Frequency | % | Group % |
|-------|--|-----------|------|--------------------------|
| 1 | Meeting rooms | 27 | 26% | Inside the office 92% |
| 2 | Each other's workstation/office | 67 | 64% | |
| 3 | Informal environment within the office | 3 | 3% | |
| 4 | Somewhere outside the office | 8 | 8% | Outside the office 8% |
| Total | | 105 | 100% | 100% |

Result S.66: WORK HABITS: Q06: Almost all (92%) work related interaction is done somewhere inside the office environment.

Result S.67: WORK HABITS: Q06: Most of the respondents (64%) prefer each other's workstation/office over meeting rooms (26%) for work related interaction.

Result S.68: WORK HABITS: Q06: More respondents (8%) prefer environments outside the office over informal environments within the office (3%) for work related interaction.

Table 7.39 is a cross analysis of the preferred place for work related interaction by profession and position. As expected, this table follows the same distribution as Table 7.38, above, and clusters the majority of respondents of both groups in each other's workstation/office, followed by meeting rooms. However, it shows that 7 out of 8 of the respondents that work somewhere outside the office (Code 4) are from group A.

Table 7.39. [Q06|A/B|SM/O] Crossanalysis: Preferred place for work related interaction by Profession and Position

| Code | Description | Group A | | | | Group B | | | |
|-------|--|---------|------|-----|------|---------|------|-----|------|
| | | A SM | | A O | | B SM | | B O | |
| 1 | Meeting rooms | 7 | 18% | 4 | 50% | 12 | 27% | 3 | 25% |
| 2 | Each other's workstation/office | 24 | 63% | 3 | 38% | 32 | 71% | 8 | 67% |
| 3 | Informal environment within the office | 1 | 3% | - | - | 1 | 2% | - | - |
| 4 | Somewhere outside the office | 6 | 16% | 1 | 13% | - | - | 1 | 8% |
| Total | | 38 | 100% | 8 | 100% | 45 | 100% | 12 | 100% |

From the above:

Result S.69: WORK HABITS: [Q06|A/B]: Performing work related interaction somewhere outside the office is preferred by more designers than accountants.

7.4.3h Face-to-face interaction (Q9)

Data collected by question:

9
How important is face-to-face interaction with workmates in daily activities?

No face-to-face interaction is required
1 ☐
2 ☐
3 ☐
4 ☐
Face to face interaction is essential in our daily activities

Table 7.40 shows the frequency of responses to question 9. Responses to scales 1 and 2 are grouped into 'unnecessary' and responses to scales 3 and 4 into 'necessary'.

Table 7.40. Q09 Frequency table: Face-to-face interaction

| Scale | Frequency | % | Group % |
|------------------|-----------|------|--------------------|
| 1 (Not required) | 8 | 8% | Unnecessary 23% |
| 2 | 16 | 15% | |
| 3 | 47 | 45% | Necessary 77% |
| 4 (Essential) | 34 | 32% | |
| Total | 105 | 100% | 100% |

From the above:

Result S.70: WORK HABITS: Q09: For most respondents (77%) face-to-face interaction is necessary as part of their daily activities. For 32% of this group, it is essential (scale 4).

Crossanalysis [Q09|A/B|SM/O], refer to Appendix 7c, shows the importance of face-to-face interaction by profession and position. This table shows a similar distribution as the above frequency table and does not show any differences between these groups.

Result S.71: WORK HABITS: [Q09|A/B|SM/O]: There are no differences in the importance of face-to-face interaction in terms of profession or position held.

However, a closer analysis done in Table [Q09=1|Q33|Q36|Q05|Q1|Q29|Q31], Appendix 7c), identified the following characteristics of the 8 respondents that considered that face-to-face interaction is not required during their daily activities (Scale 1):

- Almost all (7 out of 8) of these respondents have a lower percentage of face-to-face collaboration than the calculated average face-to-face collaboration as per Figure 7.10. (Question 5) ;
- Almost all (7 out of 8) of them belong to the senior management sub-group.
- Most (6 out of 8) work in companies with 1-10 employees. One of them hand-wrote in the questionnaire to be '*sole practitioner*'; and
- Most (5 out of 8) work at least 1 day from home. Of these five, 2 work from home (home based office).

From the above:

Result S.72: WORK HABITS: [Q09=1|Q33|Q36|Q05|Q1|Q29|Q31] [Q05]: Respondents that consider face-to-face interaction unnecessary for their daily activities (scale 1) have a lower percentage of face-to-face collaboration working mode than the calculated average. These respondents are also likely to work in small companies or be sole practitioners, and work either in a home based office or work at home at least once per week.

7.4.3i Computer adoption and dependency (Q17 and Q12)

Data collected from questions 17 and 12:

| | |
|--|--|
| 17 | What type of computer do you have at work? |
| <input type="checkbox"/> Desktop / non-portable <input type="checkbox"/> Laptop / portable <input type="checkbox"/> I do not have a computer | |
| 12 | How much do you depend on a computer for your daily work? |
| I do not need a computer to do my work <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> I could not do my work without a computer | |

Table 7.41 shows the frequency of responses to question 17. Code 4 is a combination of Code 1 (Desktop/non-portable) and Code 2 (Laptop/portable), not included in the questionnaire, but added based on response received, refer to Appendix 7b.

Table 7.41. Q17 Frequency table: Type of computer

| Code | Description | Frequency | % |
|-------|--------------------------|-----------|------|
| 1 | Desktop/non-portable | 64 | 61% |
| 2 | Laptop/portable | 34 | 32% |
| 3 | I do not have a computer | - | - |
| 4 | Desktop & Laptop | 7 | 7% |
| Total | | 105 | 100% |

From the above:

Result S.73: WORK HABITS: Q17: All respondents (100%) have at least one computer at work.

Result S.74: WORK HABITS: Q17: The majority (61%) of respondents have a desktop computer only. Some (32%) of the respondents have a laptop only. Few (7%) have both.

Crossanalysis [Q17|A/B|SM/O], refer to Appendix 7c, shows the type of computer by profession and position. From this:

Result S.75: WORK HABITS: [Q17|SM/O]: Respondents in senior management positions are more likely than respondents in other positions to have laptops.

Result S.76: WORK HABITS: [Q17|A/B|SM/O]: Designers in other positions [A|O] are more likely to have a desktop than any other sub-group.

Table 7.42 shows the respondents' dependency on a computer to do their daily work. Low dependencies (scales 1 and 2) are grouped under the 'independent' group, high dependencies (scales 3 and 4) under the 'dependent' group.

Table 7.42. Q12 Frequency table: Computer dependency

| Scale | Frequency | % | Group % |
|----------|-----------|------|-------------------|
| 1 (Low) | 3 | 3% | Independent 5% |
| 2 | 2 | 2% | |
| 3 | 6 | 5% | Dependent 95% |
| 4 (High) | 94 | 90% | |
| Total | 105 | 100% | 100% |

From the above:

Result S.77: WORK HABITS: Q12: Almost all (95%) respondents depend on a computer to do their job. From this group 90% could not do their work without a computer (scale 4).

Below are the characteristics of the 3 respondents that considered that they do not need a computer to do their daily work based on Table [Q12=1|Q34|Q36|Q33|Q28|Q17|Q18|Q19|Q21|Q22|Q23], in Appendix 7c.

- All belong to the senior management position group, 2 out of 3 are accountants;
- All have a computer at work (despite not needing it for their daily activities);
- All have broadband Internet connection;
- All have a preference of communicating via email than fax;
- 2 out of 3 have a website;
- 2 out of 3 (the same respondents as above) have a computer at home;
- 2 out of 3 (different respondents from the above) have only flat-panel monitors;
- 2 work on a 1-10 employee company, 1 in a 21-40 employee company;
- 2 consider the company they work for to be late majority technology adopter type, the remanning respondent considered it to be early adopter; and
- The age group varies from 30's to 60's.

Given the mixed, and contradictory, responses that the three respondents gave to other questions it is difficult to comment why they consider they do not need a computer to do their daily work.

Result S.78: WORK HABITS:
[Q12=1|Q34|Q36|Q33|Q28|Q17|Q18|Q19|Q21|Q22|Q23]: It is inconclusive why some respondents (3) consider that they do not require a computer to do their work.

7.4.4 Organisation context

7.4.4a Time and place flexibility (Q7 and Q8)

Data collected from questions 7 and 8.

| 7 | How flexible is your workplace about <u>when</u> employees do their work? | | | | |
|--|---|----------------------------|----------------------------|----------------------------|---|
| Employees must work within a specific time frame | | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Employees can choose when to work as long as they meet their targets |

Table 7.43 shows the frequency of responses to question 7. Responses are grouped into 'inflexible' workplaces, scales 1 and 2 and 'flexible' workplaces, scales 3 and 4.

Table 7.43. Q07 Frequency table: workplace flexibility about when employees do their work

| Scale | Frequency | % | Group % |
|----------|-----------|------|-------------------|
| 1 (Low) | 22 | 21% | Inflexible 46% |
| 2 | 26 | 25% | |
| 3 | 37 | 35% | Flexible 54% |
| 4 (High) | 20 | 19% | |
| Total | 105 | 100% | 100% |

From the above:

Result S.79: ORGANISATION CONTEXT: Q07: The majority (54%) of the respondents consider their organisations to be flexible about when employees do their work. From this group, 19% of the organisations allow employees to choose when to work as long as they meet their target.

Crossanalysis [Q07|A/B|Q33], refer to Appendix 7c, analyses the organisation's time flexibility by profession and size of the company. From this, the percentage of respondents having high flexibility (scale 4) is considerably higher in companies with 1-10 employees (A=35%, B=21%) than in companies with 11 or more employees (A=7%, B=4%) in both professions. A further analysis between professions, based on the same table, shows that designers from both company size groups have 59% of respondents in Scales 3 and 4, whereas accountants has 51% of respondents.

From the above:

Result S.80: ORGANISATION CONTEXT: [Q07|Q33]: Companies with 1-10 employees tend to be more flexible about when employees do their work than companies with 11+ employees.

Result S.81: ORGANISATION CONTEXT: [Q07|A/B]: Designers tend to be more flexible about when employees do their work than accountants.

| 8 How flexible is your workplace about <u>where</u> employees do their work? | | | | |
|--|----------------------------|----------------------------|----------------------------|---|
| Work must be done at the office | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Work may be done anywhere (home or other non-office environment) |

Table 7.44 shows the frequency of responses to question 8. Responses are grouped into 'inflexible' (Scale 1 & 2) and 'flexible' (Scales 3 & 4).

Table 7.44. Q08 Frequency table: workplace flexibility about where employees do their work

| Scale | Frequency | % | Group % |
|----------|----------------------|------|-------------------|
| 1 (Low) | 38 | 36% | Inflexible 73% |
| 2 | 39 | 37% | |
| 3 | 17 | 17% | Flexible 27% |
| 4 (High) | 10 | 10% | |
| Total | 104 (1) ⁷ | 100% | 100% |

Result S.82: ORGANISATION CONTEXT: Q08: Most of the respondents (73%) consider their organisation to be inflexible about where employees do their work.

By comparing Table 7.43 (time flexibility) and Table 7.44 (place flexibility):

⁷ 1 respondent (XX-01) registered an ambiguous response. Refer to Appendix 7a.

Result S.83: ORGANISATION CONTEXT: [Q07|Q08]: Organisations are more flexible about the time (when) work is done than the place (where) it is done.

Table [Q08|A/B|Q33], in Appendix 7c, is a crossanalysis of the organisations' place flexibility by profession and size of the company. As opposed to time flexibility (question 7) where the majority of companies (54%) are flexible, in the case of place flexibility most companies (73%) are inflexible. This crossanalysis focuses on identifying whether profession or company size has a higher influence in determining the inflexibility of companies to let their employees work outside the office environment. The profession analysis shows that designers have a higher percentage of respondents in scale 1 (44%) than accountants (32%). Likewise, for scales 1 and 2 combined (inflexible group) designers have a higher percentage of respondents (80%) than accountants (68%). In terms of company size, the percentages of respondents in scale 1 for 1-10 employees (A=48%, B=38%) are higher than the percentages of respondents in the same scale in companies with 11 or more employees (A=33%, B=25%). However, the percentage of respondents is lower in scale 1 and 2 combined for 1-10 employees (72%) than for its counterpart (77%). Thus, it is inconclusive which group by company size is less flexible, refer to Appendix 7c.

From the above:

Result S.84: ORGANISATION CONTEXT: [Q08|A/B]: Designers tend to be less flexible about where employees do their work than accountants.

Result S.85: ORGANISATION CONTEXT: [Q08|Q33]: In terms of company size it is inconclusive which group (1-10 employees/11 or more) is less flexible about when employees do their work.

From the above crossanalysis it stands out that 24% of accountants with 1-10 employees have a high place flexibility (scale 4), making this the most flexible of all sub-groups.

Result S.86: ORGANISATION CONTEXT: [Q08|A/B|Q33]: Accountants with 1-10 employees are the most flexible group about where employees do their work.

Table 7.45 is a crossanalysis between the frequency of responses for Q07 (time flexibility) and Q08 (place flexibility). The diagonal cells (bolded) show the frequency at which both parameters were equally evaluated. In scales 1 and 4, the highest frequency occurs at their intersection. In the other two scales (2 and 3) the highest frequency occurs just outside the intersection, toward less flexible time.

Table 7.45. [Q07|Q08] Crossanalysis: Time and place flexibility

| | | Q07. Time | | | | Total |
|------------|---|-----------|--------------|-----------|-----------|---------------|
| | | 1 | 2 | 3 | 4 | |
| Q08. Place | 1 | 11 | 14 | 8 | 5 | 38 |
| | 2 | 10 | 10 | 14 | 5 | 39 |
| | 3 | - | 1 | 12 | 4 | 17 |
| | 4 | 1 | - | 3 | 6 | 10 |
| Total | | 22 | 25(1) | 37 | 20 | 104(1) |

The above table best illustrates the relationship between these two variables as well as help to better understand the correlation coefficient of 0.3807 between these two parameters, refer to correlation table, Appendix 7c.

From the above:

Result S.87: **ORGANISATION CONTEXT: [Q07|Q08]:** Respondents tend to rank place flexibility equally or less flexible than time.

7.4.4b Level of bureaucracy (Q10)

Data collected by question:

| | | | | | | |
|-----------|--|----------------------------|----------------------------|----------------------------|----------------------------|--------------------------------------|
| 10 | Rank the level of bureaucracy at your workplace | | | | | |
| | Procedures are relaxed | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | Procedures must be strictly followed |

Table 7.46 shows the frequency of responses to question 10. Responses are grouped into 'relaxed' procedures, scale 1 and 2 and 'strict' procedures, scales 3 and 4.

Table 7.46. Q10 Frequency table: Level of bureaucracy

| Scale | Frequency | % | Group % |
|--------------|------------|-------------|-----------------------|
| 1 (Low) | 28 | 27% | Relaxed 61% |
| 2 | 36 | 34% | |
| 3 | 32 | 30% | Strict 39% |
| 4 (High) | 9 | 9% | |
| Total | 105 | 100% | 100% |

Result S.88: **ORGANISATION CONTEXT: Q10:** The majority of the respondents (61%) consider their organisations to be relaxed about following procedures (low level of bureaucracy). From this group, 27% considers procedures to be relaxed (scale 1).

Table [Q10|A/B|Q33], Appendix 7c, is a crossanalysis of the organisations' level of bureaucracy by profession and size of the company. In terms of the level of bureaucracy by company size, the percentages of respondents working in companies of 1-10 employees (A=29%, B=41%) with a low level of bureaucracy (scale 1) are higher than 11+ employees (A=20%, B=11%) across both professions. Likewise, companies with 1-10 employees (65%) have a higher percentage of respondents in scale 1 and 2 combined than its counterpart (56%). In terms of profession, whilst there is no difference in percentages between designers and accountants in scale 1 alone (both are 26%), in the case of scale 1 and 2 combined there is a considerable difference in respondents percentages between these groups (designers=61%, accountants=42%).

From the above:

Result S.89: **ORGANISATION CONTEXT: [Q10|Q33]:** Companies with 1-10 employees tend to be more relaxed than larger companies in their procedures (less bureaucratic).

Result S.90: ORGANISATION CONTEXT: [Q10|A/B]: Designers tend to be more relaxed in their procedures (less bureaucratic) than accountants.

7.4.4c Competitiveness at the workplace (Q11)

Data collected by question:

11 Rank the level of interpersonal-competitiveness at your workplace

Low 1 ☐ 2 ☐ 3 ☐ 4 ☐ High

Table 7.47 shows the frequency of responses to question 11. Responses are grouped into 'low-competitive' workplaces, scale 1 and 2 and 'highly-competitive' workplaces, scales 3 and 4.

Table 7.47. Q11 Frequency table: Level of interpersonal-competitiveness

| Scale | Frequency | % | Group % |
|----------|-----------|------|---------------------------|
| 1 (Low) | 32 | 30% | Low-competitive 71% |
| 2 | 43 | 41% | |
| 3 | 25 | 24% | Highly-Competitive 29% |
| 4 (High) | 5 | 5% | |
| Total | 105 | 100% | 100% |

From the above:

Result S.91: ORGANISATION CONTEXT: Q11: The majority of respondents (71%) consider their organisation to have low interpersonal competitiveness.

Table [Q11|A/B|Q33], Appendix 7c, is a crossanalysis of the level of interpersonal-competitiveness by profession and size of the company. In terms of level of interpersonal competitiveness by company size, the percentages of respondents from organisations with 1-10 employees (A=35%, B=41%) that perceive a low level of competition (scale 1) are higher than respondents working at companies with 11+ employees (A=27%, B=14%) across both professions. However, the percentage of respondents in scale 1 and 2 combined for both company size groups is equal (72%). In terms of profession, designers (33%) have a slightly higher percentage than accountants (28%) at scale 1. However, at scales 1 and 2 combined, accountants (75%) have a higher percentage of respondents than designers (67%).

From the above:

Result S.92: ORGANISATION CONTEXT: [Q11|Q33]: In terms of company size, both groups have equally low inter-personal competitiveness (scales 1 and 2). However, companies with 1-10 employees have a higher percentage of respondents in scale 1 than its counterpart.

Result S.93: ORGANISATION CONTEXT: [Q11|A/B]: In terms of profession, it is inconclusive which group perceives lower interpersonal competitiveness.

7.4.4d Green policies (Q26)

Data collected by question:

| 26 | Are there policies in your workplace to reduce the use of: | | |
|----------------|--|--|--|
| A) Electricity | ¹ <input type="checkbox"/> Yes | ² <input type="checkbox"/> Yes, but not properly followed | ³ <input type="checkbox"/> No |
| B) Water | ¹ <input type="checkbox"/> Yes | ² <input type="checkbox"/> Yes, but not properly followed | ³ <input type="checkbox"/> No |
| C) Paper | ¹ <input type="checkbox"/> Yes | ² <input type="checkbox"/> Yes, but not properly followed | ³ <input type="checkbox"/> No |
| D) Use of cars | ¹ <input type="checkbox"/> Yes | ² <input type="checkbox"/> Yes, but not properly followed | ³ <input type="checkbox"/> No |

Table 7.48 shows the frequency of responses to question 26.

Table 7.48. Q26 Frequency table: Green policies

| Code | Description | A) Electricity | | B) Water | | C) Paper | | D) Car | |
|-------|--------------------------------|----------------|------|----------|------|----------|------|--------|------|
| | | Freq. | % | Freq. | % | Freq. | % | Freq. | % |
| 1 | Yes | 27 | 26% | 24 | 23% | 43 | 41% | 20 | 19% |
| 2 | Yes, but not properly followed | 19 | 18% | 12 | 11% | 33 | 31% | 10 | 10% |
| 3 | No | 59 | 56% | 69 | 66% | 29 | 28% | 75 | 71% |
| Total | | 105 | 100% | 105 | 100% | 105 | 100% | 105 | 100% |

Based on the above table, the following was calculated for each policy and reported in the following results:

- **Percentage of companies with policy:** Refers to companies that have a policy, regardless whether they follow it properly or not. It is calculated by adding the percentage of companies in code 1 and 2.
- **Successful implementations:** Refers to companies that have properly adopted the policy. It is calculated by only taking into consideration the percentage of companies in code 1.
- **Success rate of policy:** Provides the percentage of companies that have successfully implemented the policy compared to those which have not. It is calculated by dividing the frequency of code 1 by the sum of the frequencies of codes 1 and 2.

From the above:

Result S.94: **ORGANISATION CONTEXT: Q26a:** Almost half (44%) of the respondents' companies have a policy to reduce the use of electricity, but only 26% of the companies follow the policy properly. The success rate of electricity policies across companies is 59%.

Result S.95: **ORGANISATION CONTEXT: Q26b:** Only a third (34%) of the respondents' companies has a policy to reduce the use of water, and only 23% of the companies follow the policy properly. The success rate of water policies across companies is 37%.

Result S.96: **ORGANISATION CONTEXT: Q26c:** Most (72%) of the respondents' companies have a policy to reduce the use of paper, but only 41% of the companies follow the policy properly. The success rate of paper policies across companies is 57%.

Result S.97: ORGANISATION CONTEXT: Q26d: Almost a third (29%) of the respondents' companies has a policy to reduce the use of cars, but only 19% of the companies follow the policy properly. The success rate of car policies across companies is 67%.

Result S.98: ORGANISATION CONTEXT: Q26: Paper policy is the most common (72%) policy across respondents. However, it ranks third in percentage of success (57%).

Tables [Q26a-d|A/B|Q33], refer to Appendix 7c, aim to identify relationships between having /not having a policy and the profession and size of company. Below are the results:

Result S.99: ORGANISATION CONTEXT: [Q26a|A/B]: Designers are more likely (54%) than accountants (37%) to have an electricity policy.

Result S.100: ORGANISATION CONTEXT: [Q26a|Q33]: Companies with 11+ employees are more likely (56%) than companies with less employees (37%) to have an electricity policy.

Result S.101: ORGANISATION CONTEXT: [Q26b|A/B]: Designers are more likely (50%) than accountants (23%) to have a water policy.

Result S.102: ORGANISATION CONTEXT: [Q26b|Q33]: Companies with 1-10 employees are equally likely as companies with 11+ employees (35%) to have a water policy.

Result S.103: ORGANISATION CONTEXT: [Q26c|A/B]: Designers are more likely (74%) than accountants (70%) to have a paper policy.

Result S.104: ORGANISATION CONTEXT: [Q26c|Q33]: Companies with 11+ employees are more likely (79%) than companies with 1-10 employees (67%) to have a paper policy.

Result S.105: ORGANISATION CONTEXT: [Q26d|A/B]: Designers are more likely (43%) than accountants (18%) to have a car policy.

Result S.106: ORGANISATION CONTEXT: [Q26d|Q33]: Companies with 1-10 employees are more likely (30%) than companies with 11+ employees (28%) to have a car policy.

Result S.107: ORGANISATION CONTEXT: [Q26|A/B]: Designers are more likely to have green policies (electricity, water, paper and car) than accountants.

7.4.5 Technology

7.4.5a Internet connection (Q18)

Data collected by question:

| | |
|-------------------------------------|--|
| 18 | Does your workplace have Internet connection? |
| If Yes , please specify: | |
| 1 <input type="checkbox"/> Dial-Up | 2 <input type="checkbox"/> Broadband |
| 3 <input type="checkbox"/> Wireless | 4 <input type="checkbox"/> No |

Table 7.49 shows the frequency of responses to question 18. Responses were grouped into respondents who have Internet connection (regardless of the type) and those who do not.

Table 7.49. Q18 Frequency table: Internet connection

| Code | Description | Frequency | % | Group % |
|-------|-------------|-----------|------|---|
| 1 | Dial-up | 5 | 5% | With Internet connection 100% |
| 2 | Broadband | 75 | 71% | |
| 3 | Wireless | 25 | 24% | |
| 4 | No Internet | - | - | Without Internet connection - |
| Total | | 105 | 100% | 100% |

From the above:

Result S.108: TECHNOLOGY: Q18: All respondents (100%) have Internet connection.

Result S.109: TECHNOLOGY: Q18: Over two thirds (71%) have broadband Internet connection. About a quarter (24%) have wireless connection and few (5%) have dial-up connection.

The five respondents with Dial-up connection (code 1) in the above table are further analysed based on the responses they gave to other technology questions. This analysis is done in Table [Q18=1|Q19|Q20|Q21|Q22|Q23|Q33] in Appendix 7c. From this table two extreme profiles are identified. The first, BC-26 (Accountant/City) is a small company (1-10 employees) without a website or wireless network, all of its monitors are CRT, and depends as much on faxes as on emails to send and receive information. The respondent considers the company to be laggards in terms of technology adoption. On the other hand, AS-10 (Designer/Suburb) is a large company (100-150 employees) has a website, a wireless network, has only flat-panel monitors, uses only email to send and receive information and the respondent considers the company to be Early Adopters. The remaining three respondents that have dial-up connection are a mix between the above two respondents.

Result S.110: TECHNOLOGY: [Q18=1|Q19|Q20|Q21|Q22|Q23|Q33]: Respondents with dial-up Internet connection have mixed levels of adoption, 3 out of 5 have a web page, 1 out of 5 have wireless network, 3 out of 5 have only flat panel monitors, 4 out of 5 use email over fax. Similarly the perception of the respondents about the adopter type of the company varies from scale 1 (laggards) to scale 4 (early adopters). One company has 100-150 employees; the remaining 4 have 1-10 employees.

7.4.5b Web presence (Q19)

Data collected by question:

| | | | |
|----|-----------------------------------|------------------------------|-----------------------------|
| 19 | Does your company have a website? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|----|-----------------------------------|------------------------------|-----------------------------|

Table 7.50 shows the frequency of responses to question 19.

Table 7.50. Q19 Frequency table: web presence.

| Code | Description | Frequency | % |
|-------|-------------|-----------|------|
| 1 | Yes | 79 | 75% |
| 2 | No | 26 | 25% |
| Total | | 105 | 100% |

From the above:

Result S.111: TECHNOLOGY: Q19: Three quarters of the respondents' companies (75%) have a website.

Table [Q19|A/B|Q33], in Appendix 7c, shows a crossanalysis between companies having a web site and the profession as well as the company size. Almost all of Designers (91%) have web presence, compared to the majority of Accountants (63%). Likewise, 95% of the companies with 11+ employees have web presence, whilst only 62% of companies with 10 or less employees have a website.

From the above:

Result S.112: TECHNOLOGY: [Q19|A/B]: Designers are more likely (91%) than Accountants (63%) to have web presence.

Result S.113: TECHNOLOGY: [Q19|Q33]: Companies with 11+ employees are more likely (95%) than companies with 1-10 employees (62%) to have web presence.

7.4.5c Wireless network (Q20)

Data collected by question:

| | | | |
|----|--|------------------------------|-----------------------------|
| 20 | Is there a wireless network at your workplace? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|----|--|------------------------------|-----------------------------|

Table 7.51 shows the frequency table of responses to question 20.

Table 7.51. Q20 Frequency table: wireless network.

| Code | Description | Frequency | % |
|-------|-------------|---------------------|------|
| 1 | Yes | 47 | 45% |
| 2 | No | 57 | 55% |
| Total | | 104(1) ⁸ | 100% |

⁸ Non-respondent for Q20: AS-02

From the above:

Result S.114: TECHNOLOGY: Q20: The majority of respondents (55%) do not have a wireless network.

Crossanalysis table [Q20|A/B|Q33], in Appendix 7c, shows the relationship between the companies having a wireless network and the profession as well as company size groups. Accountants are slightly more likely (47%) to have a wireless network than designers (42%). Companies with 11+ employees are more likely (51%) to have a wireless network than smaller companies (41%).

From the above:

Result S.115: TECHNOLOGY: [Q20|A/B]: Accountants are slightly more likely (47%) than designers (42%) to have a wireless network.

Result S.116: TECHNOLOGY: [Q20|Q33]: Companies with 11+ employees are more likely (51%) than companies with 1-10 employees (41%) to have a wireless network.

7.4.5d Type of monitor (Q21)

Data collected by question:

| 21 | What type of monitors are used at your workplace? | | | | |
|----|---|----------------------------|----------------------------|----------------------------|--|
| | Only CRT (non flat panel) | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Only flat panel |

Table 7.52 shows the frequency of responses to question 21. Responses were grouped into respondents who mostly have CRT monitors (scales 1 and 2) and those who mostly have flat panel monitors (scales 3 and 4).

Table 7.52. Q21 Frequency table: Type of monitor

| Scale | Frequency | % | Group % |
|-----------------------|---------------------------|-------------|---------------------------------|
| 1 (CRT) | 7 | 7% | Mostly CRT 20% |
| 2 | 13 | 13% | |
| 3 | 14 | 14% | Mostly flat panel 80% |
| 4 (Flat panel) | 69 | 66% | |
| Total | 103(2)⁹ | 100% | 100% |

Result S.117: TECHNOLOGY: Q21: Most of the respondents (80%) mostly have flat panel monitors, and 66% of them have only flat panels monitors.

A crossanalysis of the seven respondents that registered to have only CRT monitors (scale 1) is done in Table [Q21=1|Q18|Q19|Q20|Q22|Q23|Q33], Appendix 7c. This analysis shows that whilst respondents vary in their profile, they share some characteristics as summarised below.

⁹ Non-respondents to Q21: AC-55 and AC-61.

Result S.118: TECHNOLOGY: [Q21=1|Q18|Q19|Q20|Q22|Q23|Q33]: Almost all (6 out of 7) of respondents that have only CRT monitors also have broadband connection, the majority (4 out of 7) do not have a website, or wireless network (5 out of 7). Most of the respondents of this group (5 out of 7) use only email to communicate. Their adopter type varies from laggards to early majority, and almost all (6 out of 7) are small companies (1-10 employees).

7.4.5e e-mail vs. fax (Q23)

Data collected by question:

| | | | | | |
|-----------|---|----------------------------|----------------------------|----------------------------|----------------------------------|
| 23 | Does your workplace rely more on faxes or e-mails to receive and send information? | | | | |
| | E-mails | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Faxes |

Table 7.53 shows the frequency of responses to question 23. Responses on scales 1 and 2 are grouped under '*mostly emails*' and responses on scales 3 and 4 under '*mostly faxes*'.

Table 7.53. Q23 Frequency table: Email vs. fax

| Scale | Frequency | % | Group % |
|--------------|------------|-------------|------------------------------|
| 1 (E-mails) | 70 | 67% | Mostly e-mails 93% |
| 2 | 28 | 27% | |
| 3 | 7 | 7% | Mostly faxes 7% |
| 4 (Faxes) | - | - | |
| Total | 105 | 100% | 100% |

Based on the above:

Result S.119: TECHNOLOGY: Q23: Almost all of the respondents' companies (93%) rely more on e-mails than faxes to send and receive information, and 67% use only e-mails.

Result S.120: TECHNOLOGY: Q23: None of the respondents' companies rely solely on faxes to receive and send information (Scale 4).

7.4.5f Printing emails (Q24)

Data collected by question:

| | | | | | |
|-----------|--|----------------------------|----------------------------|----------------------------|--|
| 24 | Generally, non-spam e-mails, are: | | | | |
| | Always printed | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Never printed |

Table 7.54 shows the frequency of responses to question 24. Responses on scales 1 and 2 are grouped under '*frequently printed*' and responses on scales 3 and 4 under '*rarely printed*'.

Table 7.54. Q24 Frequency table: Frequency of printing emails

| Scale | Frequency | % | Group % |
|------------|-----------|------|---------------------------|
| 1 (Always) | 6 | 6% | Frequently printed 35% |
| 2 | 31 | 30% | |
| 3 | 40 | 38% | Rarely printed 65% |
| 4 (Never) | 28 | 27% | |
| Total | 105 | 100% | 100% |

From the above:

Result S.121: TECHNOLOGY: Q24: The majority of the respondents' organisations (65%) rarely print non-spam mails, 27% of them never print e-mails.

Table [Q24|A/B|Q33], in Appendix 7c, shows a crossanalysis between the frequency of printing emails and the profession and company size groups. From this table:

Result S.122: TECHNOLOGY: [Q24|A/B]: Designers (67%) tend to print less frequently non-spam emails than accountants (61%).

Result S.123: TECHNOLOGY: [Q24|Q33]: Companies with 1-10 employees (68%) tend to print non-spam emails less frequently than companies with 11+ employees (58%).

7.4.5g Document scanning (Q25)

Data collected by question:

| | | | |
|----|---------------------------------|--------------------------------|-------------------------------|
| 25 | Are hardcopy documents scanned? | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No |
|----|---------------------------------|--------------------------------|-------------------------------|

Table 7.55 shows the frequency of responses to question 25.

Table 7.55. Q25 Frequency table: Document scanning

| Code | Description | Frequency | % |
|-------|-------------|----------------------|------|
| 1 | Yes | 57 | 55% |
| 2 | No | 46 | 45% |
| Total | | 103(2) ¹⁰ | 100% |

From the above:

Result S.124: TECHNOLOGY: Q25: The majority of respondents (55%) scan hardcopy documents.

Table [Q25|A/B|Q33], in Appendix 7c, is a crossanalysis between scanning documents and the profession and company size groups. From this table:

¹⁰ There were two non-respondents.

Result S.125: TECHNOLOGY: [Q25|A/B]: Accountants (57%) are more likely to scan documents than designers (51%).

Result S.126: TECHNOLOGY: [Q25|Q33]: Most companies with 11+ employees (72%) scan documents. On the other hand, the majority (59%) of companies with 1-10 employees do not scan documents.

7.4.5h Technology adopter type (Q22)

Data collected by question:

22 Which scenario best describes the adoption of new technology in your workplace?

| | | | | | | |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--|
| We adopt technology <u>after</u> everyone else in our field | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> | We adopt technology <u>before</u> the majority in our field |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--|

Table 7.56 shows the frequency of responses to question 22 and relates the scale to Rogers' (1995) classification; refer to Chapter 2.

Table 7.56. Q22 Frequency table: Technology adopter type

| Scale – Rogers' classification | Frequency | % |
|--------------------------------|------------|-------------|
| 1 – Laggards | 4 | 4% |
| 2 – Late Majority | 17 | 16% |
| 3 – Early Majority | 33 | 31% |
| 4 – Early Adopter | 39 | 37% |
| 5 – Innovators | 12 | 12% |
| Total | 105 | 100% |

From the above:

Result S.127: TECHNOLOGY: Q22: Early adopter is the most represented (37%) adopter type, followed by early majority (31%), late majority (16%), innovators (12%) and laggards (4%).

Figure 7.11, based on crossanalysis [Q22|A/B] in Appendix 7c, shows on the left side, the distribution of adopter by profession. From this figure it can be seen that both groups shift to the right of Rogers' standard adopters' distribution indicated by the shaded area. This implies that generally respondents considered themselves to have higher adoption rate than the standard proposed by Rogers (1995). The chart on the right side of the same figure shows the sum of both groups.

Evolution of workplace architecture as a consequence of technology development

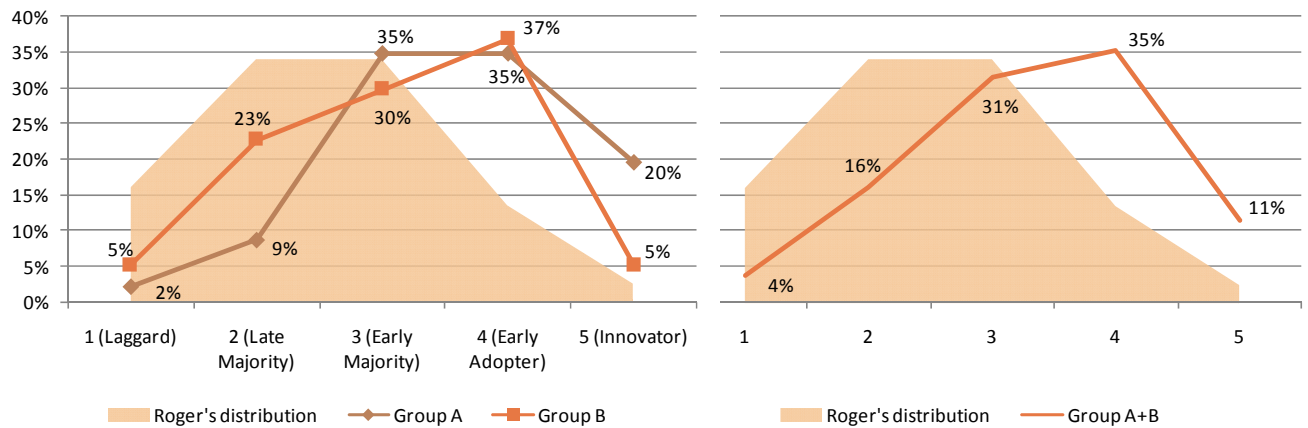


Figure 7.11. Adopter type distribution by Group A and B

The minor differences between the percentages for early adopter and innovator in Table 7.56 and the above chart (Group A+B) are due to the two respondents that removed the questionnaire ID tag (XX-01 and XX-02).

Based on the above:

Result S.128: TECHNOLOGY: [Q22|A/B]: Designers' companies are composed by 2% laggards, 9% late majority, 35% early majority, 35% early adopter and 20% innovators.

Result S.129: TECHNOLOGY: [Q22|A/B]: Accountants' companies are composed by 5% laggards, 23% late majority, 30% early majority, 37% early adopter and 5% innovators.

Figure 7.12, based on crossanalysis [Q22|Q33] in Appendix 7c, shows the distribution of technology adopter by company size.

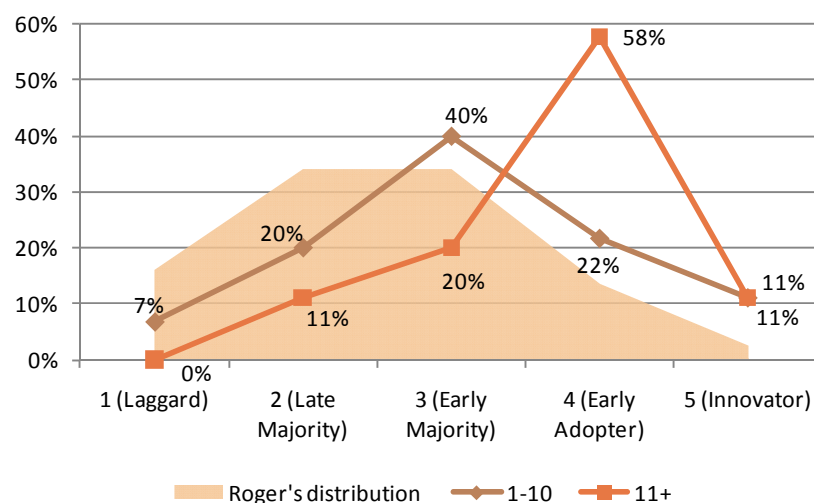


Figure 7.12. Adopter type by company size

From the above:

Result S.130: TECHNOLOGY: [Q22|Q33]: Companies with 1-10 employees are composed by 7% laggards, 20% late majority, 40% early majority, 22% early adopter and 11% innovators.

Result S.131: TECHNOLOGY: [Q22|Q33]: Companies with 11 or more employees are composed by 0% laggards, 11% late majority, 20% early majority, 58% early adopter and 11% innovators.

Crossanalysis of the 4 laggards and the 12 innovators are done in Table [Q22=1|Q17|Q18|Q19|Q20|Q21|Q23|Q33] for laggards and Table [Q22=5|Q17|Q18|Q19|Q20|Q21|Q23|Q33] for innovators, refer to Appendix 7c. These tables show that there are distinct characteristics and tendencies that define each group. Results of these crossanalysis are summarised in Table 7.57.

Table 7.57. [Q22=1/Q22=5|Q17|Q18|Q19|Q20|Q21|Q23|Q33] Crossanalysis: Laggards and Innovators characteristics

| | Laggards | Innovators |
|----------------------------|---|---|
| Internet connection | Most Laggards (3 out of 4) have Broadband connection and 1 has Dial-up, but none have wireless Internet connection. | Most Innovators (7 out of 12) have wireless Internet, none have Dial-up. |
| Website | Most laggards (3 out of 4) do not have web presence. | Most Innovators (10 out of 12) have web presence. |
| Wireless network | Laggards do not have wireless network. | Most Innovators (10 out of 12) have a wireless network. |
| Monitor type | Half of the laggards (2 out of 4) only have CRT monitors. | All Innovators have only flat panel monitors. |
| Email vs. Fax | Laggards have a varied dependency on fax to send and receive information. | Almost all innovators (11/12) use only email to send and receive information. |

From the above:

Result S.132: TECHNOLOGY: [Q22=1/Q22=5|Q17|Q18|Q19|Q20|Q21|Q23|Q33]: Innovators are more likely than laggards to use more and newer technology.

Result S.133: TECHNOLOGY: [Q22|Q19]: Innovators are more likely than laggards to have a website.

Result S.134: TECHNOLOGY: [Q22=1|Q20]: Laggards are less likely to have a wireless network.

Result S.135: TECHNOLOGY: [Q22|Q23]: Innovators are more likely than laggards to use email over fax to receive and send information.

By plotting the technology used by each adopter type, Figure 7.13 shows how technology (type and usage) tends to increase with the adopter type. Chart a), left in Figure 7.13, shows the 'representative' type of monitor per type of adopter. In this chart, the adopter type runs across the horizontal axis. The vertical axis is the scale used in question 21 to measure the adoption of flat panel monitors; Scale 1 refers to only CRT monitors, Scale 4 to only flat panel monitors. Using Tables [Q22|Q21]a and [Q22|Q21]b, in Appendix 7c, the representative type of monitor on each type of adopter was calculated. This method is detailed in Appendix 7c under Table [Q22|Q21]b. From the chart below, it can be seen that the number which represents the monitor type gets closer to 4 (flat panel only) as the adopter type increases.

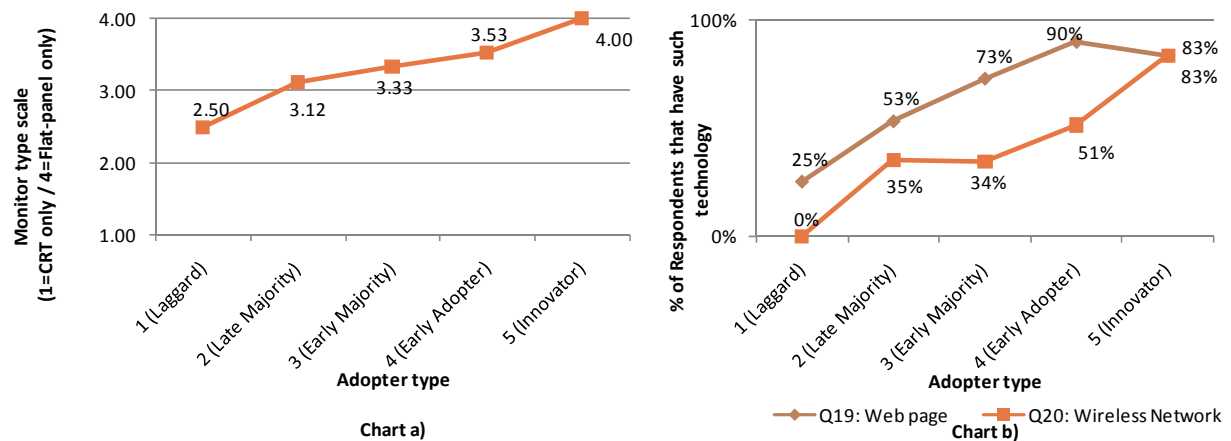


Figure 7.13. Monitor type, web page presence and wireless network based on adopter type

Chart b), right side of the above figure, shows the percentage of companies that have a web presence as measured by question 19 (top curve) as well as the percentage respondents with wireless networks as measured by question 20 (bottom curve) relative to their adopter type. These plots are based using relative frequencies as per Tables [Q22|Q19] and [Q22|Q21], refer to Appendix 7c. In this chart the percentage of companies with web presence increases with the type of adopter until early adopter. Then, the percentage declines by 7% (from 90% to 83%). The wireless network starts from 0% of adoption and almost steadily (with the exception of early majority) increases up to a maximum of 83% of adoption at the innovators category.

From the above:

Result S.136: TECHNOLOGY: Q22: In general, the adoption of technology increases with the adopter tendency towards innovation.

7.4.5i Adopter type and organisation context crossanalysis

Following is a series of analyses set to test if different adopter types have particular organisation context characteristics as discussed in section 4.2.2b *Context index* in Chapter 4.

Time and place flexibility

The underlying hypothesis is that the adoption of state-of-the-art technology could allow organisations to have greater time and place flexibility for doing work related activities (e.g. work from remote locations at different times). The set of hypotheses are:

- **H1_{time}** = “Organisations with faster adoption of technology (as measured by question 22) have higher time flexibility (as measured by question 7).”
- **H0_{time}** = “Organisations with faster adoption of technology (as measured by question 22) do NOT have higher time flexibility (as measured by question 7).”
- **H1_{place}** = “Organisations with faster adoption of technology (as measured by question 22) have higher place flexibility (as measured by question 8).”
- **H0_{place}** = “Organisations with faster adoption of technology (as measured by question 22) do NOT have higher Place flexibility (as measured by question 8).”

Figure 7.14 is a scatter diagram plotting time and place flexibility by type of technology adopter. A chart supporting H1_{time} and H1_{place} would have produced a concentration of data points running diagonally from left to right with a similar path for the regression line. However, as seen on the figure below, data points are scattered across all ranges, thus producing horizontal regression lines with almost nil R² values.

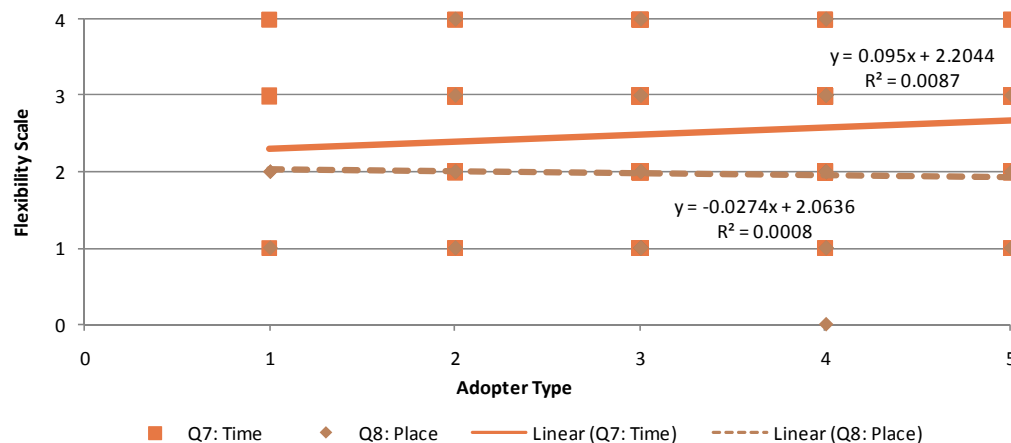


Figure 7.14. Scatter chart for time and place flexibility by Adopter type

Figure 7.15 also shows time and place flexibility by adopter type as the above figure, but in this instance it shows the calculated flexibility by type of adopter using relative frequency as per Tables [Q22|Q07]a, [Q22|Q07]b and [Q22|Q08]a, [Q22|Q08]b, refer to Appendix 7c. A similar method to the one use to calculate the type of monitor as per Chart a) in Figure 7.13 is used to calculate the representative time flexibility and place flexibility.

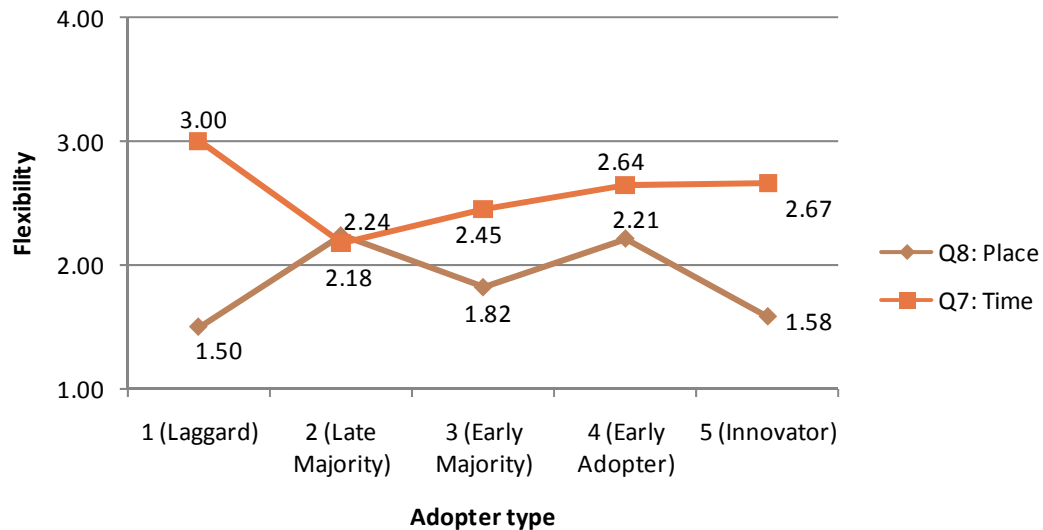


Figure 7.15. [Q22 | Q07 | Q08] Crossanalysis: Time and Place flexibility by Technology adopter type

The above figure shows that whilst there is a continuous increase of time flexibility (Q7) from late majority (scale 2) to innovators (scale 5), laggards have the highest level of flexibility amongst all types of adopters. In terms of place flexibility (Q8), the above figure shows that the flexibility alternates with the adopter type and innovators have lower place flexibility than all preceding adopter types, except laggards.

By combining the comments on Figure 7.14 and Figure 7.15 the following results are produced:

From the above:

Result S.137: TECHNOLOGY: [Q22 | Q07]: Organisations with faster adoption of technology do NOT have higher time flexibility. ($H0_{time}$)

Result S.138: TECHNOLOGY: [Q22 | Q08]: Organisations with faster adoption of technology do NOT have higher place flexibility. ($H0_{place}$)

Face-to-face interaction

The underlying hypothesis is that the adoption of state-of-the-art technology could allow organisations to replace face-to-face interaction with other types of interactions for doing work related activities (e.g. teleconferencing or even virtual worlds). The set of hypotheses are:

- **H1_{face-to-face}** = "Organisations with faster adoption of technology (as measured by question 22) consider face-to-face interaction less important (as measured by question 9)."
- **H0_{face-to-face}** = "Organisations with faster adoption of technology (as measured by question 22) do NOT consider face-to-face interaction less important (as measured by question 9)."

Figure 7.16 is a scatter diagram plotting the importance of face-to-face interaction by type of technology adopter. As previously mentioned in the above scatter diagram (Figure 7.14) a chart supporting the positive hypothesis $H1_{\text{face-to-face}}$ would have produced a concentration of data points running diagonally from left to right with a similar path for the regression line. However, data points are scattered, thus producing a horizontal regression line with low R^2 value.

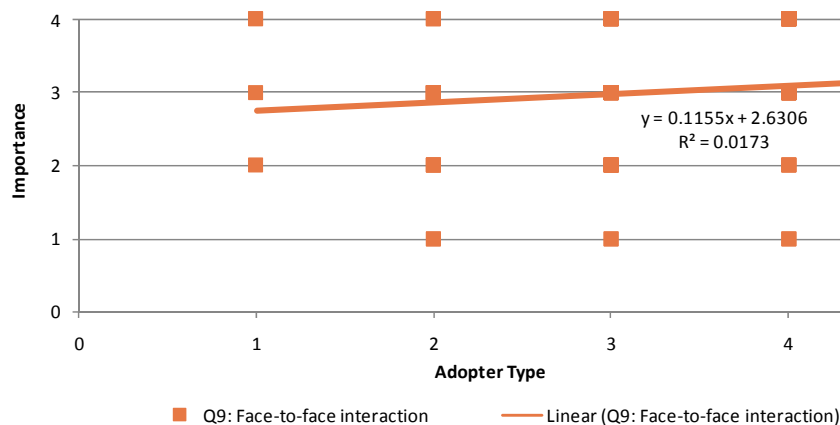


Figure 7.16. Scatter chart for importance of face-to-face collaboration by Adopter type

Figure 7.17 shows importance of face-to-face collaboration by adopter type calculated using relative frequency as per Tables [Q22|09]b, refer to Appendix 7c.

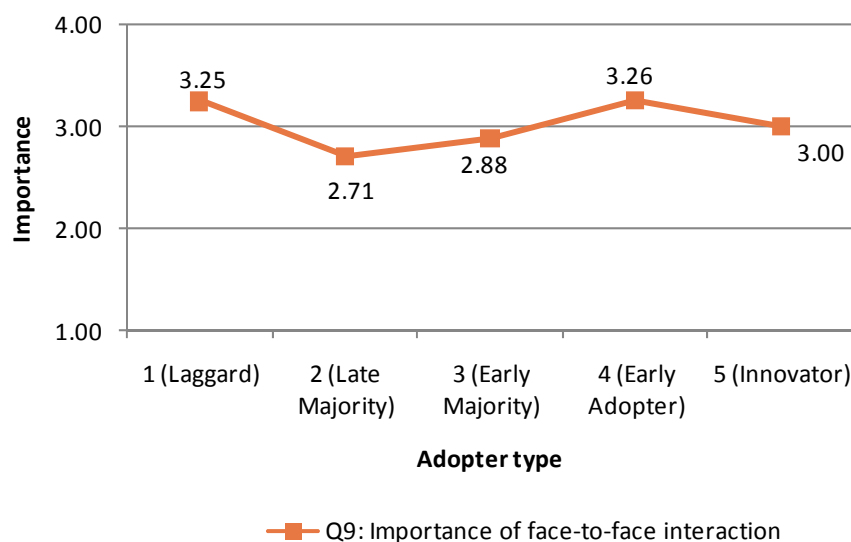


Figure 7.17. [Q22|Q9] Crossanalysis: Face-to-face interaction by Technology adopter type

From the above figure it can be seen that the calculated level of importance of face-to-face collaboration varies, without an identifiable pattern, with the type of technology adopter. Thus, and despite laggards (3.25) having a higher calculated level of importance than Innovators (3.00), this small difference and the fluctuation between the intermediate adopters do not support $H1$.

Based on the above:

Result S.139: TECHNOLOGY: [Q22|Q9]: Organisations with faster adoption of technology do NOT consider face-to-face interaction less important. ($H0_{\text{face-to-face}}$)

Bureaucracy

As previously explained in section 4.2.2b *Context index*, there are two sides to the relationship between technology adoption and bureaucracy level. The first refers to the hypothesis that state-of-the-art systems could reduce the level of perceived bureaucracy (independent of the actual level) by managing all the process internally without the involvement of the user. The second is that for state-of-the-art technology to be adopted a certain level of flexibility in the procedures is required to allow for new ways of doing things. However, both cases could be summarised in one underlying hypothesis which states that faster adopters will have (perceived or real) lower level of bureaucracy for doing work related activities. The set of hypotheses are:

- $H1_{\text{Bureaucracy}}$ = “Organisations with faster adoption of technology (as measured by Question 22) have less bureaucracy (as measured by Question 10).”
- $H0_{\text{Bureaucracy}}$ = “Organisations with faster adoption of technology (as measured by Question 22) do NOT have less bureaucracy (as measured by Question 10).”

Figure 7.18 is a scatter diagram plotting the perceived level of bureaucracy by type of technology adopter. As mentioned in the previous scatter diagrams (Figure 7.14 and Figure 7.16) a chart supporting the positive hypothesis $H1_{\text{bureaucracy}}$ would have produced a concentration of data points running diagonally from left to right with a similar path for the regression line. However, data points are scattered, thus producing a horizontal regression line with low R^2 value. Still, this is the steepest line of all scatter diagrams (slope of 0.151) with the highest (although still low) R^2 value (0.0265). It also shows that adopter type 1 (laggards) does not have flexibility levels higher than 2 and adopter type 2 (late majority) does not have the highest flexibility level.

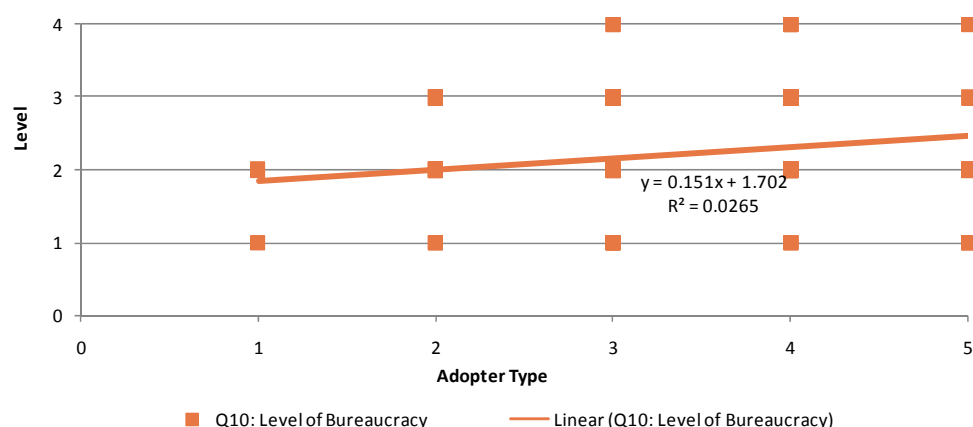


Figure 7.18. Scatter chart for level of bureaucracy by Adopter type

Figure 7.19 plots the level of bureaucracy by adopter type calculated using relative frequency as per Tables [Q22|Q10]b, refer to Appendix 7c.

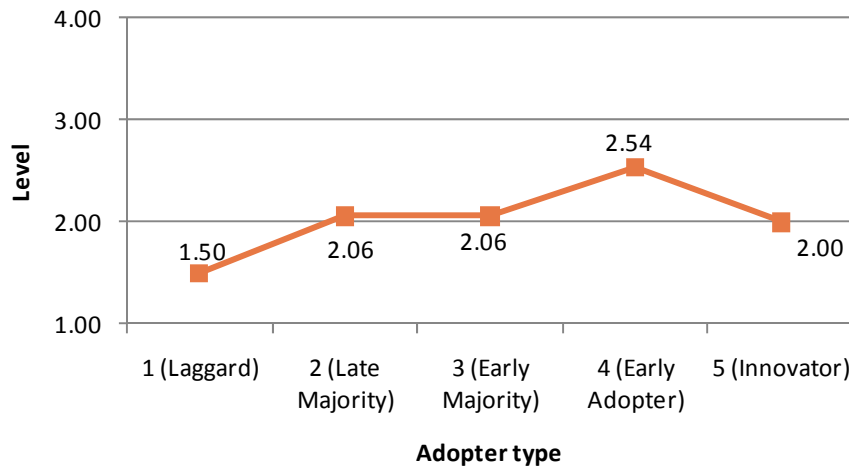


Figure 7.19. [Q22 | Q10] Crossanalysis: Level of bureaucracy by Technology adopter type

From the above figure, laggards (1.50) have the lowest level of bureaucracy, then it increases to an equal level for late majority and early majority (2.06), then goes up again for early adopters (2.54). However, it goes down (below late and early majority) for innovators (2.00).

Based on the above:

Result S.140: TECHNOLOGY: [Q22 | Q10]: Organisations with faster adoption of technology do NOT have less bureaucracy. ($H0_{\text{Bureaucracy}}$)

Paper dependency

The underlying hypothesis is that companies with a higher level of adoption of technology prefer accessing information digitally and thus have less dependency on paper. In fact, their processes might require access to documents in digital format rather than paper (for remote access, for example). It could be thus expected that innovators have less dependency on paper and as a consequence rarely print emails, but scan documents. The opposite is expected from the laggards. The set of hypotheses are:

- **H1_{Paper}** = “Organisations with higher type of adoption of technology (as measured by question 22) have a lower dependency on paper (as measured by question 24 and 25).”
- **H0_{Paper}** = “Organisations with higher type of adoption of technology (as measured by question 22) do NOT have a lower dependency on paper (as measured by question 24 and 25).”

Figure 7.20 plots the frequency of printing non-spam emails by adopter type calculated using relative frequency as per Tables [Q22 | Q24]b, refer to Appendix 7c.

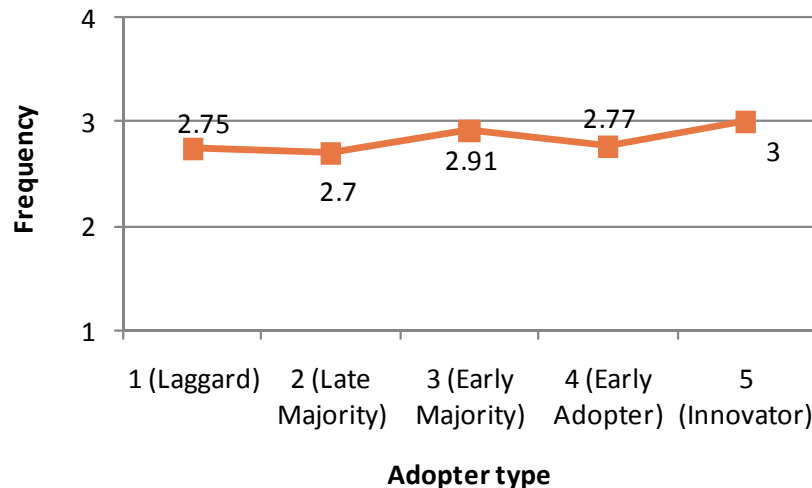


Figure 7.20. [Q22|Q24] Crossanalysis: Frequency of printing non-spam emails by Technology adopter type

From the above figure, laggards (2.75) have lower calculated frequency of printing emails than innovators (3.0). However, the difference is small and the frequency fluctuates in the in-between adopter types.

The crossanalysis between the adopter type and scanning hardcopy documents done in Table [Q22|Q25], Appendix 7c, shows that: laggards do not scan hardcopy documents. However, the majority (59%) of late majority adopters as well as the majority (52%) of early majority adopters and most (72%) of early adopters scan documents. Unexpectedly, however, most (75%) innovators do not scan documents.

Based on the above:

Result S.141: TECHNOLOGY: [Q22|Q24|Q25]: Organisations with higher type of adoption of technology do NOT have a lower dependency on paper. ($H_{0_{\text{paper}}}$)

7.4.6 Alternative Ways of Working (AWW)

From the various AWW described in Chapter 2, the survey focused on two specific types: hot-desking and, in more depth, teleworking. Results are as below.

7.4.6a Hot-desking (Q27)

Data collected by question:

| | | | |
|----|--|--------------------------------|-------------------------------|
| 27 | Are desks / workstations shared in your office? (E.g Hot-desking) | 1 <input type="checkbox"/> Yes | 2 <input type="checkbox"/> No |
|----|--|--------------------------------|-------------------------------|

Table 7.58 shows the frequency of responses to question 26.

Table 7.58. Q27 Frequency table: Hot-desking

| Code | Description | Frequency | % |
|-------|-------------|-----------|------|
| 1 | Yes | 21 | 20% |
| 2 | No | 83 | 80% |
| Total | | 104 (NR) | 100% |

From the above:

Result S.142: ALTERNATIVE WAYS OF WORKING: Q27: Most of the respondents' companies (80%) have not implemented hot-desking.

Table [Q27|A/B|Q33], Appendix 7c, explores the relationships between having /not having hot-desking and the profession and size of company. Below are the results:

Result S.143: ALTERNATIVE WAYS OF WORKING: [Q27|A/B]: Designers (28%) are more likely to have hot-desking than accountants (13%).

Result S.144: ALTERNATIVE WAYS OF WORKING: [Q27|Q33]: Companies with 1-10 employees (25%) are more likely to have hot-desking than companies with 11+ employees (12%).

7.4.6b Teleworking as an option (Q29)

Data collected by question:

29 Is teleworking (working from home) an option at your workplace?

If **Yes**, please specify:

1 ☐ I work from home days a week

2 ☐ I do not use this option, I rather go to the office

If **No**, please specify:

3 ☐ I would like to have the option of working from home

4 ☐ I rather go to the office

Table 7.59 shows the frequency of responses to question 29. Responses to codes 1 and 2 are grouped into the 'yes' group, which adds up the companies in which teleworking is an option regardless whether the respondent is working in such mode or not. Codes 3 and 4 are grouped into the 'no' group, which adds up the companies that do not offer this type of working mode. A third group, the 'no/no' group are those respondents (3) that ticked both options 2 and 4, refer to Appendix 7b. For this group, it is unknown if the option of teleworking is available or not, but what is clear is that, on either case, they would rather go to the office.

Table 7.59. Q29 frequency table: Teleworking as an option at workplace

| Code | Description | Freq. | % | Group |
|-------|---|--------|------|-------------|
| 1 | Yes, and I work from home (see Table 7.60) | 23 | 22% | Yes 46% |
| 2 | Yes, but I do not use this option | 25 | 24% | |
| 3 | No, but I would like to have the option | 12 | 12% | No 51% |
| 4 | No, but I rather go to the office | 41 | 39% | |
| 5 | With or without option, I would rather go to the office | 3 | 3% | No/No 3% |
| Total | | 104(1) | 100% | 100% |

From the above:

Result S.145: ALTERNATIVE WAYS OF WORKING: Q29: Less than half the companies (46%) offer teleworking to their employees. From this percentage, 48% of respondents work from home at least 1 day a week. The remaining 52% prefer to go to the office.

Result S.146: ALTERNATIVE WAYS OF WORKING: Q29: The majority of the companies (51%) do not offer teleworking to their employees. From this percentage, 23% of the respondents would like to have the option of working from home. The remaining 77% do not want this option.

Result S.147: ALTERNATIVE WAYS OF WORKING: Q29: In the case of some respondents (3%), it is unknown if their workplace offers teleworking. However, they would not take this option regardless of it being offered.

By adding codes 2, 4 and 5, from the above table, the percentage of respondents that do not, or would not, telework even with the option is obtained. The result is as follows:

Result S.148: ALTERNATIVE WAYS OF WORKING: Q29: Most of the respondents (66%) would rather go to the office than telework.

Table 7.60 shows the frequency of days worked from home by respondents who telework (those who ticked code 1).

Table 7.60. Q29=1 Frequency table: Number of days worked from home

| | Freq. | % |
|--------|-------|------|
| 1 Day | 15 | 65% |
| 2 Days | 2 | 9% |
| 3 Days | 2 | 9% |
| 4 days | 1 | 4% |
| 5 Days | 3 | 13% |
| 6 Days | - | - |
| 7 Days | - | - |
| Total | 23 | 100% |

From the above:

Result S.149: ALTERNATIVE WAYS OF WORKING: Q29=1: Most of the respondents (65%) that telework do so only 1 day a week.

Table 7.61 is a summary showing the percentages only of the crossanalysis of teleworking by profession and company size as per Table [Q29|Q33|A/B] in Appendix 7c.

Table 7.61. [Q29|Q33|A/B] Crossanalysis summary: Teleworking by Profession and Company size

| Code | Description | Group A | Group B | 1-10 | 11+ |
|-------------------|---|---------|---------|------|------|
| 1 | Yes, and I work from home | 24% | 21% | 29% | 14% |
| 2 | Yes, but I do not use this option | 20% | 25% | 20% | 26% |
| 3 | No, but I would like to have the option | 15% | 9% | 8% | 16% |
| 4 | No, but I rather go to the office | 37% | 43% | 37% | 44% |
| 5 | With or without option, I would rather go to the office | 4% | 2% | 5% | - |
| Total (%) | | 100% | 100% | 100% | 100% |
| Total (Frequency) | | 46 | 56 | 59 | 43 |

From the above:

Result S.150: ALTERNATIVE WAYS OF WORKING: [Q29|A/B]: Designers (24%) are more likely than accountants (21%) to telework. Designers (15%) are also more likely than accountants (9%) to wanting to have the option of teleworking.

Result S.151: ALTERNATIVE WAYS OF WORKING: [Q29|Q33]: Respondents working in companies with 1-10 employees (29%) are more likely than larger companies (14%) to work from home.

Result S.152: ALTERNATIVE WAYS OF WORKING: [Q29|Q33]: The group in which teleworking is not offered and the respondent is not interested in teleworking (Code 4) concentrates the highest percentage of respondents across all groups, designers 37%, accountants 43%, companies with 1-10 employees 37% and larger companies 44%.

7.4.6c Advantages and disadvantages of teleworking (Q30)

Data collected by question:

| 30 Which do you think are the pros and cons of working from home? <i>Tick all applicable</i> | |
|--|--|
| Pros | Cons |
| 1.p <input type="radio"/> More free time | 1.c <input type="radio"/> Isolation |
| 2.p <input type="radio"/> Increased productivity | 2.c <input type="radio"/> Longer working hours |
| 3.p <input type="radio"/> Less commuting time | 3.c <input type="radio"/> Lack of motivation |
| 4.p <input type="radio"/> Freeing up of office space | 4.c <input type="radio"/> Lack of a suitable environment at home |
| 5.p <input type="radio"/> More time with my family | 5.c <input type="radio"/> No boundaries between home and work |

Table 7.62 shows the frequency of responses to question 30. Responses are grouped into 'advantages' for codes 1.p to 5.p and 'disadvantages' for codes 1.c to 5.c.

Table 7.62. Q30 Frequency table: Advantages and Disadvantages of Teleworking

| | Code | Description | Frequency | % | Total by group |
|------|------|-------------------------------------|-----------|-----|--------------------------------|
| Pros | 1.p | More free time | 35 | 16% | Advantages 224 (100%) |
| | 2.p | Increased productivity | 36 | 16% | |
| | 3.p | Less commuting time | 84 | 38% | |
| | 4.p | Freeing up of office space | 22 | 10% | |
| | 5.p | More time with my family | 47 | 20% | |
| Cons | 1.c | Isolation | 61 | 25% | Disadvantages 246 (100%) |
| | 2.c | Longer working hours | 27 | 11% | |
| | 3.c | Lack of motivation | 42 | 17% | |
| | 4.c | Lack of a suitable environment | 41 | 17% | |
| | 5.c | No boundaries between home and work | 75 | 30% | |

From the above:

Result S.153: ALTERNATIVE WAYS OF WORKING: Q30: Overall, respondents identified more disadvantages (246) than advantages (224).

Result S.154: ALTERNATIVE WAYS OF WORKING: Q30: The most common advantage of teleworking selected across all respondents is '*less commuting time*' (38%), followed by '*more time with family*' (20%), then with equal percentage (16%) '*more free time*' and '*increased productivity*', finally '*freeing up of office space*' (10%).

Result S.155: ALTERNATIVE WAYS OF WORKING: Q30: The most common disadvantage of teleworking selected across all respondents is '*no boundaries between home and work*' (30%), followed by '*isolation*' (25%), then with equal percentage (17%) '*lack of motivation*' and '*lack of a suitable environment*', finally '*longer working hours*' (11%).

In order to differentiate between the perceived advantages and disadvantages from respondents that currently telework from those who do not and are therefore speculating on the pros and cons, a crossanalysis by teleworkers/non-teleworkers and their perceived advantages and disadvantages is done in Tables [Q30|Q29]a and [Q30|Q29]b, refer to Appendix 7c. Based on these tables:

Result S.156: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: Respondents that telework (49%) were slightly more likely to chose an advantage for teleworking than non teleworkers (41%). On the other hand, non-teleworkers were considerably more likely to select a disadvantage for teleworking (53%) than teleworkers (28%).

Based on the above tables, Figure 7.21 sorts advantages (above horizontal line) and disadvantages (below horizontal line) by percentage of respondents that ticked such option. Responses from teleworkers are shown on the left and from non-teleworkers on the right.

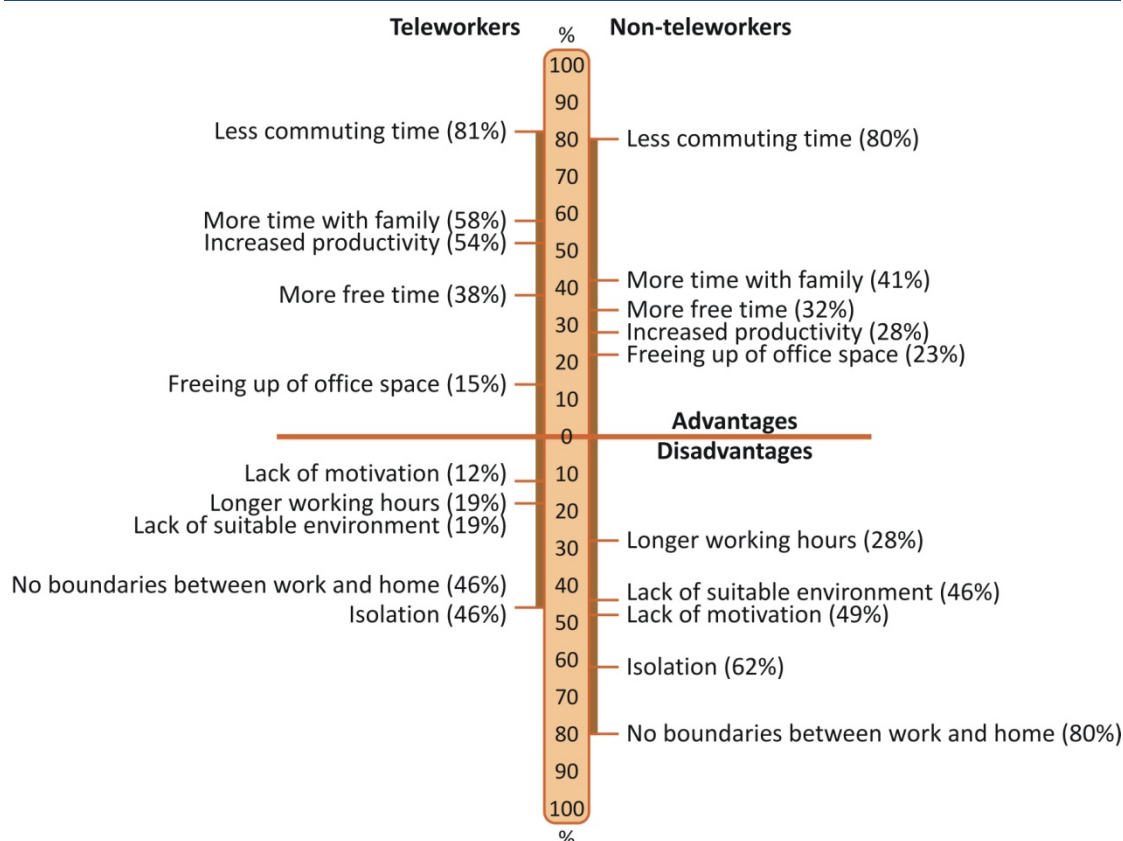


Figure 7.21. Advantages and disadvantages of teleworking by teleworkers and non-teleworkers

From the above

Result S.157: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: The percentage range of disadvantages identified by non-teleworkers is higher (up to 80%) than the one of teleworkers (up to 46%).

Result S.158: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: Almost equal percentage of respondents that telework (81%) and do not telework (80%) consider '*less commuting time*' to be an advantage of teleworking.

Result S.159: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: Most respondents that do not telework (80%) consider '*no boundaries between home and work*' to be a disadvantage of teleworking. However, less than half of the respondents that telework (46%) considered that.

Result S.160: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: The majority of respondents that telework (58%) consider '*more time with family*' to be an advantage of teleworking. However, less than half of the respondents that do not telework (41%) consider that.

Result S.161: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: Most respondents that do not telework (62%) consider '*isolation*' to be a disadvantage of teleworking. However, less than half of the respondents that telework (46%) consider that.

Result S.162: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: More respondents that do not telework (49%) consider '*lack of motivation*' as a disadvantage of teleworking than teleworkers (12%).

Result S.163: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: The majority of respondents that telework (54%) consider '*increased productivity*' to be an advantage of teleworking. However, less than a third of respondents that telework (28%) consider that.

Result S.164: ALTERNATIVE WAYS OF WORKING: [Q30|Q29]: More respondents that do not telework (46%) consider '*lack of suitable environment*' as a disadvantage of teleworking than teleworkers (19%).

7.4.6d Technology at home (Q28)

Data collected by question:

28 Which of the following you have at HOME? *Tick all applicable*

1 ☐ Computer 2 ☐ Printer 3 ☐ Fax 4 ☐ Dial-up / 5 ☐ Broadband / wireless Internet

Table 7.63 shows the frequency of responses to question 28.

Table 7.63. Q28 Frequency table: Technology at home

| Code | Description | Have | | Do not have | | Total | Total |
|------|-----------------------------|-------|-----|-------------|-----|-------|-------|
| | | Freq. | % | Freq. | % | Freq. | % |
| 1 | Computer | 103 | 98% | 2 | 2% | 105 | 100% |
| 2 | Printer | 87 | 83% | 18 | 17% | 105 | 100% |
| 3 | Fax | 29 | 28% | 76 | 72% | 105 | 100% |
| 4 | Dial-up | 13 | 12% | 92 | 88% | 105 | 100% |
| 5 | Broadband/wireless Internet | 83 | 79% | 22 | 21% | 105 | 100% |

From the above:

Result S.165: ALTERNATIVE WAYS OF WORKING: Q28: Almost all (98%) respondents have a computer at home and Internet connection (91%), most (83%) have a printer and some (28%) have a fax.

Result S.166: ALTERNATIVE WAYS OF WORKING: Q28: Most (91%) of respondents have Internet access at home, 79% have Broadband/wireless and 12% have Dial-up Internet access.

7.4.6e Travel time to work

Data collected by question:

| | | |
|----|---|---|
| 31 | On average, how much time does it take to commute? (Return) | <input style="width: 50px;" type="text"/> Hrs <input style="width: 50px;" type="text"/> Min |
|----|---|---|

Table 7.64 shows the frequency of responses to question 31. Responses are grouped into ranges of 15 minutes.

Table 7.64. Q31 Frequency table: Travel time to work

| Time range (HH:MM) | | Freq. | % | Accumulated | % Accum |
|--------------------|-----------|----------------------|------|-------------|---------|
| 1 hr or less | 0:01-0:15 | 11 | 11% | 11 | 11% |
| | 0:16-0:30 | 22 | 21% | 33 | 32% |
| | 0:31-0:45 | 11 | 11% | 44 | 43% |
| | 0:46-1:00 | 23 | 22% | 67 | 66% |
| 2 hrs or less | 1:01-1:15 | 6 | 6% | 73 | 72% |
| | 1:16-1:30 | 11 | 11% | 84 | 82% |
| | 1:31-1:45 | 3 | 3% | 87 | 85% |
| | 1:46-2:00 | 10 | 10% | 97 | 95% |
| More than 2hrs | 2:01-2:15 | 2 | 2% | 99 | 97% |
| | 2:16-2:30 | 2 | 2% | 101 | 99% |
| | 5:00 | 1 | 1% | 102 | 100% |
| Total | | 102(3) ¹¹ | 100% | | |

Result S.167: ALTERNATIVE WAYS OF WORKING: Q31: The majority of respondents (66%) spend 1 hr or less in daily commuting to work (return).

One respondent (AC-55) registered 5hrs of travel time every day. The respondent handwrote “live at Phillip Island and come to the city each day” next to her response. She uses public transport and works 38 hours per week. She would not consider teleworking and spends 100% of her time at the office building relationships and socialising. She is in her 40’s and is the manager of a design company, in the city, with 1-10 employees. The respondent has a computer, and broadband at home.

Result S.168: ALTERNATIVE WAYS OF WORKING: Q31: The respondent with the longest commuting time of the study spends 5 hours (return) each day commuting to work using public transport. Despite already having a computer and broadband at home, the respondent would not consider teleworking. She is in her 40’, is the manager of a design company with 1-10 employees located in the city and spends 100% of her time at the office building relationships and socialising.

¹¹ Three respondents work from home (AS-05, AS-07 and BS-24). Thus, they registered ‘0’ Hrs and ‘0’ minutes of travel time.

Result S.169: ALTERNATIVE WAYS OF WORKING: Q31: The range '0:46-1:00' concentrates the highest percentage (22%) of respondents in a single range, closely followed by the '0:16-0:30' range (21%). The shortest travel time range of '01-0:15' concentrates 11% of the respondents.

7.4.6f Type of transport

Data collected by question:

32 On a typical day, which is your main way of transportation to get to work?

1 ☐ By foot / Bicycle 2 ☐ Public transport 3 ☐ Scooter / Motorcycle 4 ☐ Car

Table 7.65. Q32 Frequency table: type of transport

| Code | Description | Frequency | % |
|-------|----------------------|----------------------|------|
| 1 | By foot / Bicycle | 15 | 15% |
| 2 | Public transport | 18 | 18% |
| 3 | Scooter / Motorcycle | - | - |
| 4 | Car | 67 | 67% |
| Total | | 100(5) ¹² | 100% |

Form the above:

Result S.170: ALTERNATIVE WAYS OF WORKING: Q32: The majority of respondents (67%) use cars as the main way of transportation to get to work.

Result S.171: ALTERNATIVE WAYS OF WORKING: Q32: The percentage of respondents using public transport to get to work (18%) is slightly higher than the percentage travelling by foot or bicycle (15%).

Table 7.66 is a crossanalysis of the transport used by respondents and the location of their workplace.

Table 7.66. [Q32|A/B] Crossanalysis: transport by geographic location

| Group | Foot/Bicycle | | Public Transport | | Use car | | Total | % |
|--------|--------------|-----|------------------|-----|---------|-----|------------------|------|
| City | 8 | 16% | 13 | 27% | 28 | 57% | 49 | 100% |
| Suburb | 7 | 14% | 5 | 10% | 37 | 76% | 49 | 100% |
| Total | | | | | | | 98 ¹³ | |

¹² As previously mentioned AS-05, AS-07 and BS-24 work from home, thus they do not commute to work. Respondents BC-19 and BC-63 provided invalid data (refer to Appendix 7b). The total number of answers for this question is 100.

¹³ Respondents XX-01 and XX-02 registered "Car" as their main transport to work, but since they do not belong to city or suburb their response is not taken into consideration for this analysis

Result S.172: ALTERNATIVE WAYS OF WORKING: [Q32|A/B]: The percentage of respondents using cars to get to their workplace in the suburbs (76%) is higher than the percentage of respondents using cars to get to their workplace in the city (57%).

Result S.173: ALTERNATIVE WAYS OF WORKING: [Q32|A/B]: The percentage of respondents using public transport to get to their workplace in the city (27%) is higher than the percentage of respondents using public transport to get to their workplace in the city (10%).

7.5 SUMMARY

A total of 105 out of 284 questionnaires were completed and returned by randomly sampled participants in Melbourne (City and Suburbs). A process was developed and implemented to monitor the manual input of data into the system in order to ensure the quality of the data used for analysis. Likewise, responses from each returned questionnaire were checked for potential source of error and bias before its analysis.

The survey produced a total of 173 results, from which 7 are from Demographics, 24 Office environment, 47 Work habits, 29 Organisation context, 34 Technology and 32 Alternative ways of working. Significance tests of inter-group comparisons are done in Chapter 11. Discussion of these results, together with those obtained by the case studies is also done in Chapter 11.

CASE STUDY A

CHAPTER

8

8.1 INTRODUCTION

This case study analyses a contemporary office environment.

The first section of this chapter documents the implementation of the case study. The second section details the analysis of the case study covering the same areas and following the same structure as the analysis done in Chapter 7. This case study is based on the data collected by the questionnaire, Work Sampling Diary (WSD) and floor plan analysis.

8.2 CASE STUDY IMPLEMENTATION

A Director of an architectural design firm was approached in early October 2007 to invite his company to participate in the study. An introduction to the research and its purpose together with a sample of the survey and WSD were given to him for his review and consideration.

Following the acceptance to participate, 5 case study kits, refer to Appendix 6b, were given to him on Tuesday 16th of October 2007. At the end of such week the Director distributed the material to 5 participant selected by him. He was not part of the study. The study began on Monday 22nd of October and as such the WSD covers the week from the 22nd to the 28th of October (both dates inclusive). The survey was completed sometime during that week.

All five participants returned their completed questionnaires and WSD, together with the respective signed RMIT's Ethics Consent Form by the first week of November 2007. By mid November pictures of the participants' workstations and floor plans were provided.

8.2.1 Data quality

The quality of data collected by this case study considerably exceeds that of the data collected by the survey in Chapter 7. On the other hand, there were gaps in the information collected by the WSD which limited the extent of the analysis.

To ensure the accuracy of the data inputted into the system, the double-input process explained in Chapter 7 was implemented on the questionnaire and WSD. However, this was done using only one person's input (input A1 and A2) and the input time was not monitored nor the number of errors recorded.

8.3 CASE STUDY ANALYSIS

8.3.1 Company overview

The company is a medium size design firm that specialises in small to medium commercial architectural projects. The practice was established in 1970 and at the time of the analysis (2008) had a total of 34 people (29 general staff and 5 directors). With the exception of the

IT manager and the business manager, all employed staff are architects, designers or drafters.

8.3.2 General demographics

Case Study A participants are represented by four males and one female. Three of the males are Directors. Two of them are in their 30's (CSA-3 and CSA-5) and one in his 50's (CSA-2). The remaining male is a Project Coordinator in his 50's (CSA-1). The female participant is in her 20's and works as Project Co-ordinator (CSA-4), refer to Table 8.1.

Table 8.1. Participants' profile

| Participant | Gender | Age group | Position |
|-------------|--------|-----------|----------------------|
| CSA-1 | Male | 50's | Project Co-ordinator |
| CSA-2 | Male | 50's | Director |
| CSA-3 | Male | 30's | Director |
| CSA-4 | Female | 20's | Project Co-ordinator |
| CSA-5 | Male | 30's | Director |

8.3.3 Office environment

In 2006 the company moved into a new one-storey office building owned by the firm in a northeast suburb in Melbourne. Although the building envelope was already built, the company had the opportunity to design the interior of the building. Having a clean floor plan was an ideal opportunity for the company to produce a design that best address their needs without having to overcome challenging constrains (other than the ones imposed by the geometry of the floor plan). This condition is also advantageous for the case study as it allowed to study a supposedly ideal working environment.

The building is located on a street corner with street views on the north and west elevations and an adjoining tenancy on the south and east boundaries. The floor plan is a 25m x 20m (500m²) rectangle with the longest side running north-south. Access to the building is provided via a commercial arcade on the south side. Two stairs, located at opposite corners, provide access from and to the car park located in the basement.

The office layout is open plan with modular office furniture. Figure 8.1 shows interiors of the floor plan.



Figure 8.1. Internal views

An analysis of the floor plan is shown on Figure 8.2. Case study participants' workstations (marked in red) are labelled 'CSA-1' to 'CSA-5'. Most of the floor plan area is used as office space (blue) with four workstations (pink) used as hot-desks. There are four dedicated meeting spaces (green): the board room, two enclosed meeting rooms and one informal open meeting area.

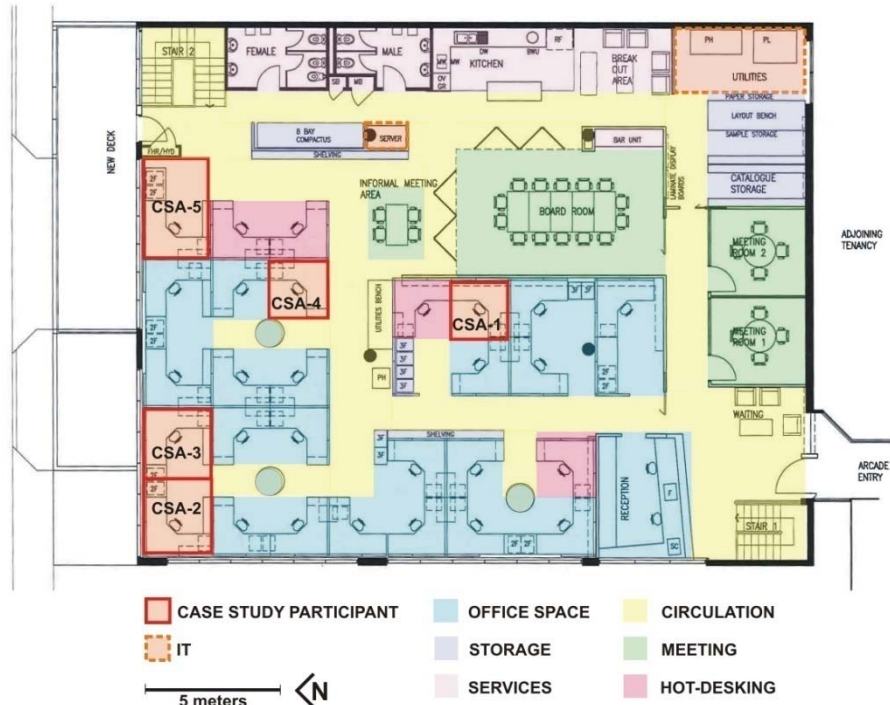


Figure 8.2. Floor plan analysis

It is noticeable that the drawing board, which has traditionally always been a distinctive feature in the offices of architects and designers, has been completely replaced by CAD (Computer Aided Design) workstations and printers. As a consequence, the distinctive traditional office layout of architects created by the drawing boards, as shown in Figure 8.3, now blends with that of other offices from other disciplines.



Figure 8.3. Design studios, left 1943 right 1948 (LIFE 2009)

Result CS-A.1: OFFICE ENVIRONMENT: Floor Plan: IT can standardise the layout of offices across disciplines.

The company's office model can be associated with Giuliano's (1985) Information Age office, refer to Chapter 2. Unlike Giuliano's Industrial age office, people are not distributed as parts of a production line, instead they are grouped in teams where they know (and need to know) the overall task (project) to which they are contributing. It is certainly not pre-industrial because the company benefits from technology in their processes and employees do not necessarily need to physically move to retrieve information. Further, there is a clear claim of space by technology on each workstation as well as a defined area for printers and ICT (server).

Result CS-A.2: OFFICE ENVIRONMENT: Floor Plan: The company has an Information age office model layout as described by Giuliano (1985).

Even though the firm is yet to adopt a VDC approach as described in Chapter 2, the need of collaboration amongst team members is manifested on the floor plan by including meeting tables (green shade) inside the workstation islands, refer to Figure 8.2. When required, the team can turn their chairs around the table and have a modest version of an iRoom equivalent to that of Team X (see Chapter 2).

Result CS-A.3: OFFICE ENVIRONMENT: Floor Plan: The office layout reflect the need of team collaboration.

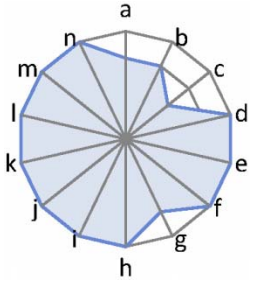

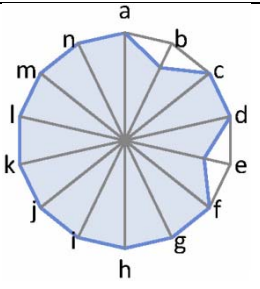

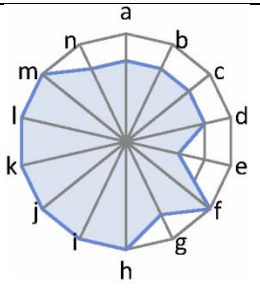

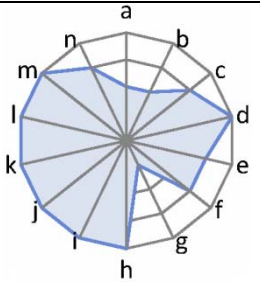

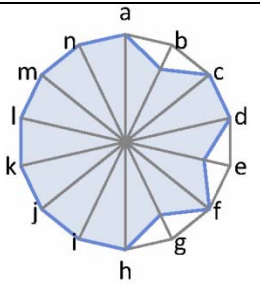

From Figure 8.2 it is noticeable that all staff, regardless of their position (Senior Management/Other) work in the same type of modular workstation and in an open layout. Thus, it is difficult to distinguish between the offices, or better said, workstations of a Director and a Project Coordinator. The office layout does not reflect hierarchy. Although, it is worth mentioning that the 3 Directors (CSA-2, CSA-3 and CSA-5) are next to a window, whereas the project co-ordinations (CSA-1 and CSA-4) are deeper into the office.

Result CS-A.4: OFFICE ENVIRONMENT: Floor Plan: All employees work in the same type of modular workstation.

Result CS-A.5: OFFICE ENVIRONMENT: Floor Plan: The floor plan does not reflect hierarchy.

As seen on the environment radar charts in Table 8.2, the West quadrant (parameters h to m), which measures spatial satisfaction, is consistently ranked with the highest score (Scale 4) across all participants. On the other hand, there are noticeable differences amongst the East quadrant (parameters a to g), which measures environment comfort and privacy levels. The most variable parameter is *g) Voice privacy*, ranging from '1 Poor' (CSA-4) to '4 Good' (CSA-2), the two opposite sides of the scale. The next parameter with the highest variability is *a) Temperature Comfort* with two participants considering it '4 Good' (CSA-2 and CSA-5) and one participant considering it '2 Medium Poor' (CSA-4). One parameter that consistently registered less than '4 Good' across all participants is *b) Ventilation comfort*.

Table 8.2. Participants' environment satisfaction and workstation

| | | |
|-------|---|--|
| CSA-1 |  |  |
| CSA-2 |  |  |
| CSA-3 |  |  |
| CSA-4 |  |  |
| CSA-5 |  |  |

Key to Chart: a) Temperature comfort, b) Ventilation comfort, c) Illumination comfort, d) Noise comfort, e) Frequency of distractions, f) Visual privacy, g) Voice privacy, h) Spatial arrangement, i) Furniture arrangement, j) Office size, k) Office storage, l) Storage space, m) Space on work station, n) Overall satisfaction.

From the above:

Result CS-A.6: OFFICE ENVIRONMENT: Q02: The office environment successfully satisfies spatial parameters (h to m) across all participants.

Result CS-A.7: OFFICE ENVIRONMENT: Q02: The office environment fails to equally satisfy comfort and privacy parameters across participants. The most variable parameter is '*g) Voice privacy*'.

The pictures of workstations shown on Table 8.2, above, show a noticeable reduction of the technology footprint on the work bench gained by the introduction of flat panel monitors. However, this benefit is diminished by having the CPU on the bench top (see CSA-1, CSA-2, CSA-4 and CSA-5).

Result CS-A.8: OFFICE ENVIRONMENT: Workstation pictures: Flat panel monitors can reduce the foot print of technology on workstation.

From these same pictures, the difference in the tidiness of desks and amount of hardcopy documents on top of desks is evident. This could simply reflect differences in the personal level of tidiness or suggest different levels of paper dependency. As previously mentioned the assessments of parameters *l) Individual storage space* and *m) Work space available on workstation* have the highest score across all participants.

From the above:

Result CS-A.9: OFFICE ENVIRONMENT: [Q02] Workstation pictures]: The different levels of tidiness of the workstation is a personal effect rather than a shortage of storage and the perception of the size of working space is unaffected by the increased amount of clutter.

In Chapter 5 it is discussed that the way people perceive the environment depends as much on its objective characteristics as on other subjective factors. This case study benefits from knowing the location of the case study participants on the floor plan, making it possible to extend the analysis of the office environment.

Following are a series of analyses to help determine if the differences on the East quadrant (parameters '*a*' to '*g*') are due to identifiable objective differences in the participants' surroundings or subjective assessments. For this, the values of these parameters are plotted on the floor plan in order to identify and separate physical (objective) circumstance from personal perception (subjective).

8.3.3a Temperature and ventilation perceptions

Figure 8.4 indicates the location of the five case study participants (CSA-1 to CSA-5) together with their perceived temperature (square) and ventilation (circle) comfort. With the exception of one participant (CSA-4), the rest are mostly satisfied with the temperature and ventilation (scales 3 and 4). However, there is no evident environmental circumstance, or a clear pattern, that would explain the discomfort experienced by CSA-4. It is worth mentioning that no thermal analysis was done and the analysis is made solely based on the information provided by the floor plan and reflected ceiling plan shown in Figure 8.5.

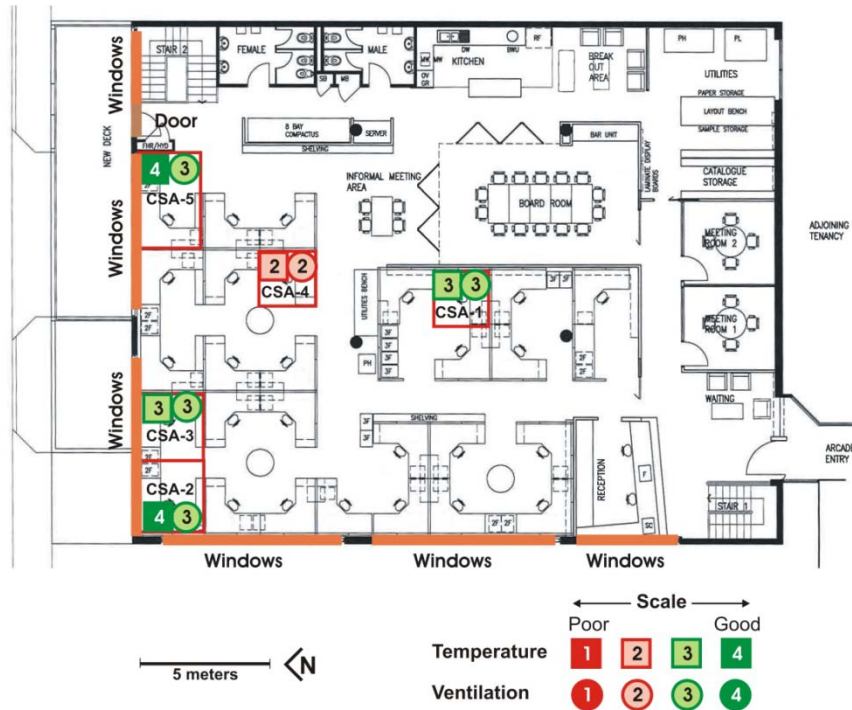


Figure 8.4. Temperature and ventilation floor plan analysis

The above figure also highlights the correlation between temperature and ventilation as previously discussed in Chapter 7.

Figure 8.5 shows the layout of luminaires and air supplies providing light and air to the case study participants. The fittings follow the distribution of the ceiling tiles, not shown for clarity of the drawing and only the fittings related to the participants are shown.

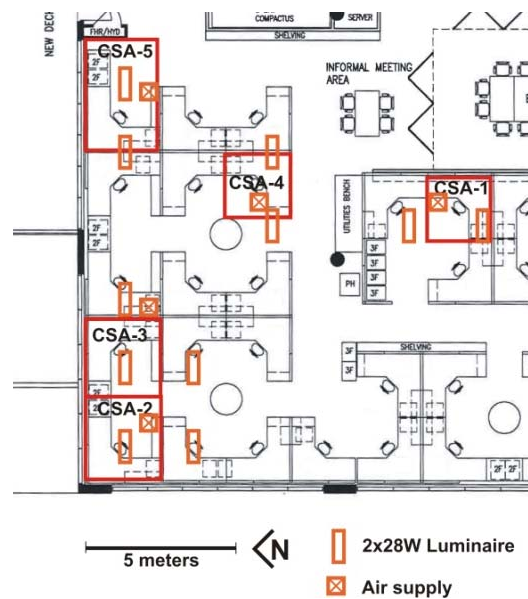


Figure 8.5. Reflected ceiling layout

Even though CSA-4 has an Air supply right on top of her, the layout is not that different from that of CSA-1.

From the above:

Result CS-A.10: OFFICE ENVIRONMENT: [Q02|Floor plan | Reflected ceiling plan]: There are no apparent objective reasons for the temperature and ventilation discomfort experienced by participant CSA-4.

Result CS-A.11: OFFICE ENVIRONMENT: [Q02]: The consistency by which participants assess temperature and ventilation comfort suggests a correlation between these two parameters.

8.3.3b Illumination perception

Figure 8.6 indicates the location of the five case study participants with their perceived illumination comfort. The analysis seems to indicate that the distance from the windows and the number of partitions in between, may be an objective reason behind the low illumination satisfaction from CSA-1. As with the previous analysis, the illumination analysis was also made based on the floor plan information and reflected ceiling plan, no illumination levels were measured.

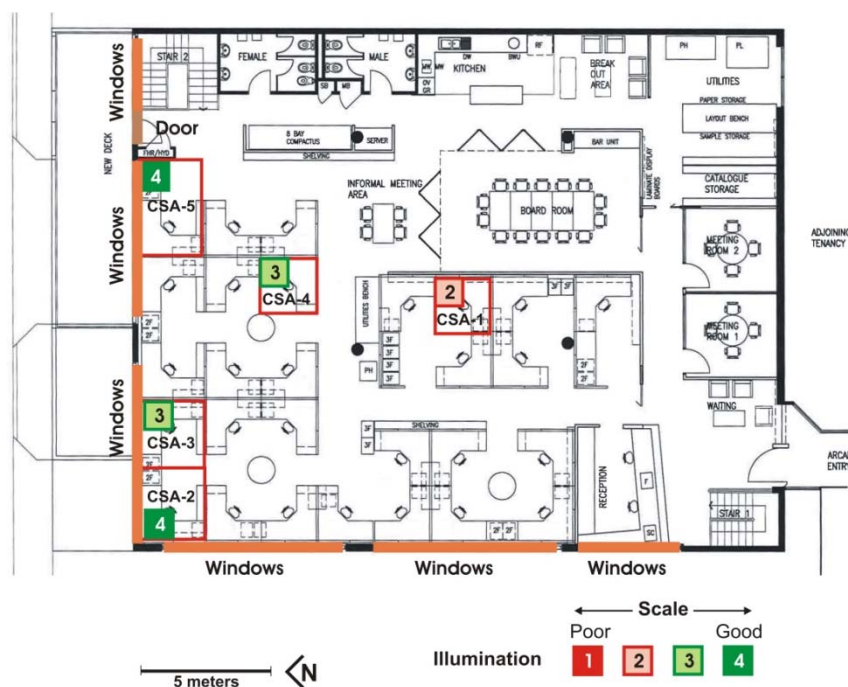


Figure 8.6. Illumination floor plan analysis

From the above:

Result CS-A.12: OFFICE ENVIRONMENT: [Q02]: The distance from a natural source of light (window) is a plausible objective explanation for CSA-1 lower illumination satisfaction.

The reflected ceiling layout (Figure 8.5) shows that there is a luminaire on top of CSA-1 which should improve the illumination satisfaction when lit.

8.3.3c Privacy and distractions perception

Figure 8.7 shows the participants' level of satisfaction on the remaining 4 environment parameters: background noise (square), frequency of distractions (circle), visual privacy (inverted triangle) and voice privacy (triangle). In general, the level of background noise (*d*) and visual privacy (*f*) are mostly good for all participants. However, as previously mentioned, perception of voice privacy (*g*) has the highest difference across participants.

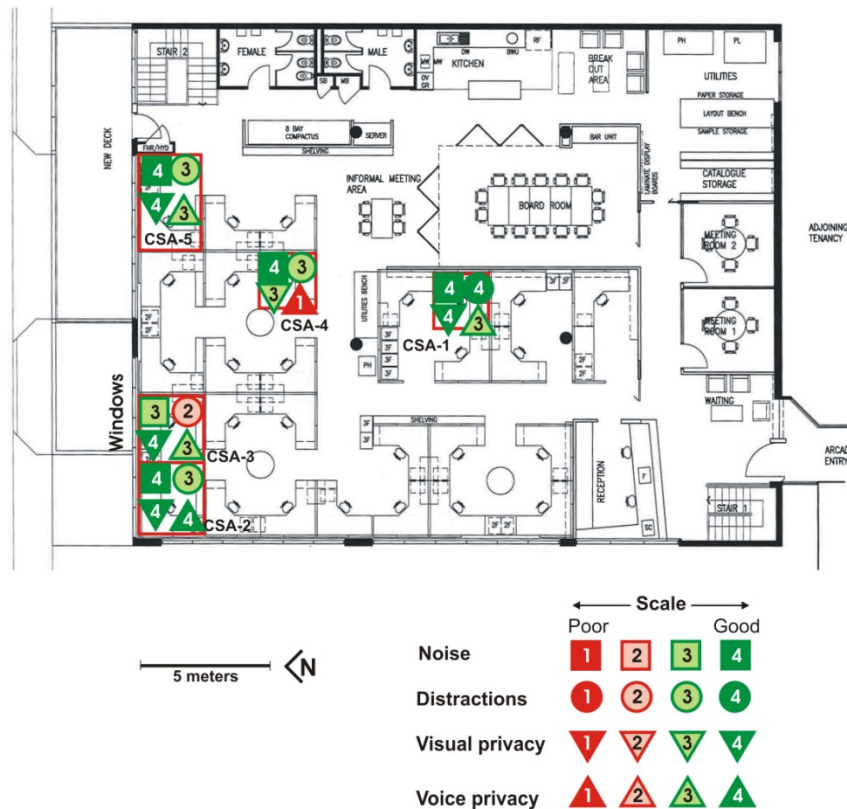


Figure 8.7. Noise, distractions, visual and voice privacy floor plan analysis

A possible explanation to the perceived lack of voice privacy of CSA-4 might be her proximity to the informal meeting area and main corridor. On the other hand, the frequency of distractions reported by CSA-3 could be more related to job specific characteristics than to the physical environment. Although, it is noted that CSA-2 and CSA-5 are also Directors and do not report frequent distractions.

8.3.4 Work habits

8.3.4a Amount of work

Table 8.3 summarises the amount of work done by each participant as collected by questions 13, 14, 15 and 16 of the questionnaire. The number inside the parenthesis on questions 14 and 15 indicates the scale (from 1 to 4).

Table 8.3. Amount of work as recollected by Q13, Q14, Q15 and Q16

| Participant | Hrs worked per week (Q13) | Takes work home (Q14) | Works on weekends (Q15) | Happy with work/life balance (Q16) |
|-------------|---------------------------|-----------------------|-------------------------|------------------------------------|
| CSA-1 | 40 | Never (1) | Never (1) | Yes |
| CSA-2 | 40 | Frequently (3) | Frequently (3) | Yes |
| CSA-3 | 40 | Sometimes (2) | Sometimes (2) | Yes |
| CSA-4 | 39 | Never (1) | Sometimes (2) | Yes |
| CSA-5 | 45 | Never (1) | Sometimes (2) | No |

The number of working hours (Q13) varies from 39 hours per week (CSA-4) to 45 hours per week (CSA-5), with the majority of participants working 40 h.p.w. The highest variability is in the frequency at which participants take work home (Q14) and how frequently they work over weekends (Q15), which varies from *never*(1) to *frequently*(3) in both cases. CSA-2 reported that he frequently takes work home as well as works on weekends, whilst CSA-1 is the opposite.

Result CS-A.13: WORK HABITS: [Q13]: Participants work an average of 40.8 h.p.w. The highest number of w.h.p. (45) is registered by CSA-5 (Director). The lowest (39) is registered by CSA-4 (Project Co-ordinator).

Based on the criteria set on Chapter 7 and the position of the participants described on Table 8.1, CSA-2, CSA-3 and CSA-5 belong to the senior management sub-group whereas CSA-1 and CS-4 to the 'other' sub-group. Taking into consideration the hours worked per week, the frequency by which participants take work home and work on weekends, senior management participants work more than participants in the other sub-group.

Result CS-A.14: WORK HABITS: [Q13|Q14|Q15|Q36]: Senior management participants (CSA-2, CSA-3 and CSA-5) have on average a higher workload than participants in other positions (CSA-1 and CSA-4).

With the exception of CSA-5, all participants are happy with their work/life balance. A possible explanation for CSA-5 dissatisfaction could be that he works five hours per week more than the others (one hour more per day per week). However, CSA-5 never takes work home and just works some weekends, whilst CSA-2 frequently takes work home and works on weekends and reported being happy with his work life/balance.

There are differences in the amount of work registered on the survey component of the case study (Table 8.3 above) and in the WSD, Table 8.4. CSA-1 has the highest difference with approximately 9 hrs less registered in the WSD than on the questionnaire. It is worth noting, however, that the questionnaire is meant to collect typical working hours as opposed to the WSD which is a daily sample over one week. The comment on the representativeness of the week shows that CSA-1 had a "*quieter week than usual*", which could explain the difference of almost 2hrs per day, refer to Appendix 8a.

Table 8.4. Amount of work as recollected by WSD

| Participant | Hrs worked per week (HH:MM) | Took work home | Worked on weekend |
|-------------|-----------------------------|----------------|-------------------|
| CSA-1 | 30:45 | No | No |
| CSA-2 | 27:20* | 1 Day | Yes (Sat&Sun) |
| CSA-3 | 35:40 | No | No |
| CSA-4 | 24:05** | No | No |
| CSA-5 | 31:30* | No | No |

The hours worked by CSA-2 and CSA-5, marked with an asterisk '*', could not be accurately calculated because the 'Left work' field in the booklet was not completed for at least one day, which made it difficult to calculate the total number of hours worked (the system assigns a '0' hrs value for dates missing the 'Left work' value). In the case of CSA-4, marked with two asterisks '**', the participant failed to register the 'Left work' time one day and had one sick day, refer to Appendix 8a.

The 'took work home' and 'worked on weekend' responses are compatible between the questionnaire and WSD.

8.3.4b Working mode

Data collected from question number 5 of the questionnaire shows that participants spend most of their time (60% to 80%) doing individual work, face-to-face meeting time varies from 15% to 30% and socialising and building relationships represent only 5% to 10% of the participants' time, refer to Survey reports on Appendix 8a. Figure 8.8 shows the average percentage of time spent in the three different working modes.

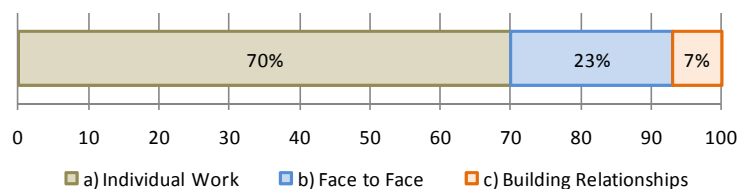


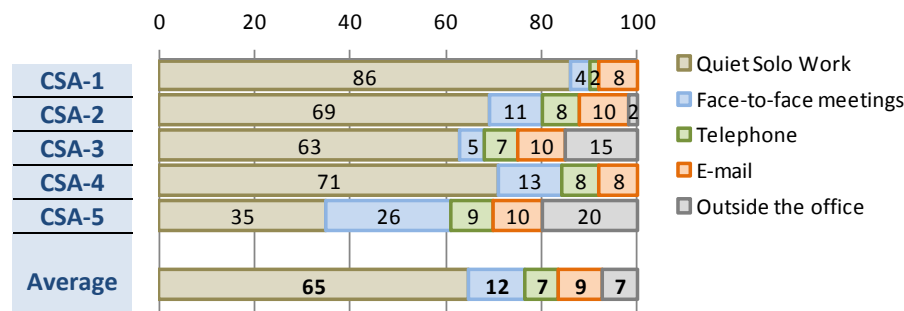
Figure 8.8. Average percentage of time spend in working modes (Q05)

Form the above:

Result CS-A.15: WORK HABITS: Q05: On average, participants spend 70% doing individual work and quiet thinking, 23% face-to-face collaboration and 7% building relationships and socialising.

Table 8.5 shows the average percentage of time spend in the 5 working modes measured by the WSD by participant. The bottom row of this figure shows the average across all participants.

Table 8.5. Type of work (WSD)



From the above:

Result CS-A.16: WORK HABITS: WSD: On average participants spend 65% doing quiet solo work, 12% in face-to-face meetings, 7% talking over the telephone, 9% writing/reading e-mails and 7% outside the office.

Result CS-A.17: WORK HABITS: WSD: The majority of participants spend more time communicating over e-mail than telephone. The highest difference is 2% Telephone, 8% e-mail. Only one participant spends the same percentage of time on both.

The WSD includes the statement: “*I could have done today’s work from home or other place outside the office*” with a 4 step scale level of agreement. Table 8.6 shows the daily results (Monday to Friday) by participant.

Table 8.6. Capacity of doing today’s work from outside the office

| CSA-1 | | CSA-2 | | CSA-3 | | CSA-4 | | CSA-5 | | Scale |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------------------------|
| Day | Value | Day | Value | Day | Value | Day | Value | Day | Value | |
| Mon | 1 | Mon | 1 | Mon | 3 | Mon | 4 | Mon | 3 | Disagree 1 ↑ 2 ↓ 3 Agree 4 |
| Tue | 1 | Tue | 1 | Tue | 1 | Tue | 2 | Tue | 1 | |
| Wed | 1 | Wed | 1 | Wed | 3 | Wed | 3 | Wed | 3 | |
| Thu | 1 | Thu | 1 | Thu | 1 | Thu | n/a | Thu | 3 | |
| Fri | 1 | Fri | 3 | Fri | 2 | Fri | 2 | Fri | 3 | |

From the above, CSA-1 considers that he could have not worked from anywhere outside the office for the whole week. On the other hand, CSA-5 considers he could have possibly worked outside the office 4 out of 5 days. Only CSA-4 fully agrees that she could have worked 1 day (Monday) from a place outside the office. On Monday this last participant spend 80% of her time doing quiet solo work, 10% in face-to-face meetings, 5% over the telephone and 5% on writing/reading emails, refer to Appendix 8a. This day was the day with the highest percentage of quiet solo work for her.

The high percentage of time spend by CSA-1 doing quiet solo work (the highest across all participants) together with the percentage of time working with emails, indicate that this participant spends almost all of his time (96%) performing activities which do not require face-to-face interaction or an office location to receive calls.

Result CS-A.18: WORK HABITS: WSD: Participant CSA-1 spends on average almost all of his time (96%) doing quiet solo work (86%) and writing/reading emails (8%) and he completely disagrees that he could work from home or other place outside the office.

Result CS-A.19: WORK HABITS: WSD: Participant CSA-5 spends on average 35% of his time doing quiet solo work, 26% in face to face-meetings, 9% over the telephone, 10% writing/reading emails and 20% outside the office and considers that he could possibly work four out of five days from home or somewhere outside the office.

Result CS-A.20: WORK HABITS: WSD: Participant CSA-4 agrees that on one day, she could have worked from home or somewhere outside the office. During this day she spend 80% of her time doing quiet solo work, 10% in face-to-face meetings, 5% over the telephone and 5% on writing/reading emails.

8.3.5 Organisation context

Table 8.7 summarises the responses to the organisation context questions 7, 8, 10, 11, 12 and 4 of the questionnaire. The number inside the parenthesis indicates the scale (from 1 to 4).

Table 8.7. Organisation context

| | CSA-1 | CSA-2 | CSA-3 | CSA-4 | CSA-5 |
|-------------------------------------|----------------|----------------|----------------|-------------|--------------|
| Time flexibility (Q7) | Flexible (3) | Inflexible (2) | | | Flexible (3) |
| Place flexibility (Q8) | Inflexible (2) | Flexible (3) | Inflexible (2) | | Flexible (3) |
| Bureaucracy level (Q10) | Relaxed (1) | | Strict (3) | Relaxed (2) | |
| Competitiveness (Q11) | High (3) | Low (1) | Low (2) | Low (1) | |
| Computer dependency (Q12) | High (4) | | High (3) | High (4) | |
| Work station dependency (Q4) | High (4) | High (3) | High (4) | | High (3) |

From the above:

Result CS-A.21: ORGANISATION CONTEXT: Q07: The majority of participants (3) consider the organisation to be inflexible (Scale 2) about the time when employees need to do their work. The remaining participants (2) consider the organisation flexible (Scale 3).

Result CS-A.22: ORGANISATION CONTEXT: Q08: The majority of participants (3) consider the organisation to be inflexible (Scale 2) about the place where employees need to do their work. The remaining participants (2) consider the organisation flexible (Scale 3).

Result CS-A.23: ORGANISATION CONTEXT: Q10: The perception of the bureaucracy level varies across participants, with two considering the organisation to be relaxed (Scale 1) in its procedures, other two participants relaxed (Scale 2) and the reminding participant strict (3).

Result CS-A.24: ORGANISATION CONTEXT: Q11: The perception of interpersonal competitiveness varies across participants, three consider it to be low (Scale 1), one low (Scale 2) and one high (Scale 3).

Result CS-A.25: ORGANISATION CONTEXT: Q12: The majority of participants (4) have a very high dependency (Scale 4) on a computer to do their daily work. The remaining participant has a high (Scale 3) dependency.

Result CS-A.26: ORGANISATION CONTEXT: Q04: The majority of participants (3) spend most of their time (Scale 4) on their workstation. The remaining two, have a high dependency (Scale 3).

8.3.6 Technology

Table 8.8 summarises the response to the technology questions 17, 18, 19, 20, 21, 23, 24 and 25 of the questionnaire.

Table 8.8. Technology at work Q17, Q18, Q19, Q20, Q21, Q23, Q24 and Q25

| | CSA-1 | CSA-2 | CSA-3 | CSA-4 | CSA-5 |
|-----------------------------|-----------------|----------------|----------------|----------------|----------------|
| Type of computer (Q17) | Desktop | | | | |
| Internet Connection (Q18) | Broadband | | | | |
| Website (Q19) | Yes | | | | |
| Wireless network (Q20) | No | | | | |
| Type of monitors used (Q21) | Only flat panel | | | | |
| E-mails vs. Fax (Q23) | E-mails only | | Mostly e-mails | | |
| Scanning of documents (Q25) | No | Yes | No | | Yes |
| E-mails are (Q24) | Mostly printed | Rarely printed | Mostly printed | Always printed | Rarely printed |

From the above:

Result CS-A.27: TECHNOLOGY: [Q17|Q18|Q19|Q20|Q21|Q23|Q24]: All participants have a desktop computer and all monitors in the office are flat-panel. The office has broadband Internet connection and a webpage, but no wireless network. Participants use e-mail over fax to communicate. Scanning of documents as well as printing of e-mails varies across participants.

Figure 8.9 maps the perceived technology adopter type (Q22) by participant against Rogers (1995) adoption distribution curve.

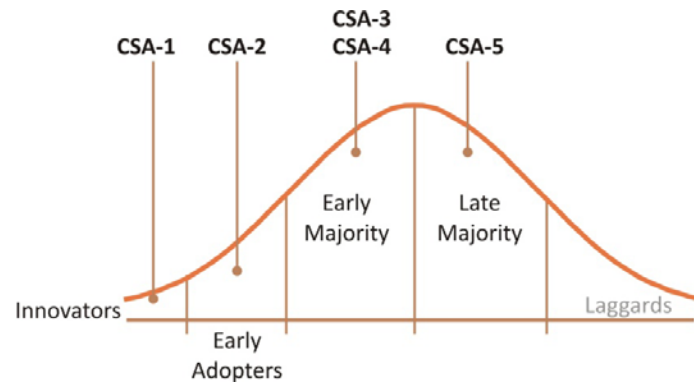


Figure 8.9. Adopter type as perceived by participant Q22

From the above:

Result CS-A.28: TECHNOLOGY: Q22: The perception of adopter type varies considerably across participants, going from “Innovators” to “Late Majority”.

Table 8.9 summarises the responses to question 28 indicating the technology that participants have at home.

Table 8.9. Participants’ technology at home Q28

| | CSA-1 | CSA-2 | CSA-3 | CSA-4 | CSA-5 |
|--------------------|-------|-------|-------|-------|-------|
| Computer | ✓ | | ✓ | ✓ | ✓ |
| Printer | ✓ | | ✓ | ✓ | |
| Fax | | ✓ | | | |
| Internet Broadband | ✓ | | ✓ | ✓ | ✓ |

From the above:

Result CS-A.29: TECHNOLOGY: Q28: Almost all (4 out of 5) participants have a computer at home. All the participants that have a computer at home have broadband Internet. The majority of participants (3 out of 4) that have a computer also have a printer. The only participant that has a fax is the same without a computer.

8.3.7 Alternative Ways of Working

Table 8.10 summarises the responses given to questions 6, 27, 29, 31 and 32 related to AWW.

Table 8.10. Alternative Ways of Working (AWW) Q06, Q27, Q29, Q31, Q32

| | CSA-1 | CSA-2 | CSA-3 | CSA-4 | CSA-5 |
|-----------------------------------|--|-------|-------|-------|-------|
| Hot-desking implemented (Q27) | No | Yes | No | | |
| Preferred interaction space (Q06) | Each other's workstations / office | | | | |
| Teleworking option offered (Q29) | Yes, but I do not want to use this option, I rather go to office | | | | |
| Commuting time (in Minutes) (Q31) | 40 | 20 | 60 | 25 | 75 |
| Transport type (Q32) | Car | | | | |

From the above:

Result CS-A.30: ALTERNATIVE WAYS OF WORKING: [Q27|Floor plan]: Only one participant knows that hot-desking is implemented at their office. Floor plan analysis shows 4 workstations dedicated to this purpose.

Result CS-A.31: ALTERNATIVE WAYS OF WORKING: Q06: All participants prefer each other's workstations for work related interaction.

Result CS-A.32: ALTERNATIVE WAYS OF WORKING: Q29: All case study participants (5) answered that teleworking is an option available at their office but they do not use it and they rather go to the office.

Result CS-A.33: ALTERNATIVE WAYS OF WORKING: [Q31|Q32]: All participants commute to their workplace by car. The average commuting time is 44 minutes. The quickest trip (CSA-2) takes 20 minutes, the longest (CSA-5) 75 minutes.

Table 8.11 and Table 8.12 show

Table 8.11. Perceived advantages of working from home

| | CSA-1 | CSA-2 | CSA-3 | CSA-4 | CSA-5 | Total |
|----------------------------|-------|-------|-------|-------|-------|-------|
| More free time | | | | | | - |
| Increased productivity | | | | | | - |
| Less commuting time | ✓ | ✓ | ✓ | ✓ | ✓ | 5 |
| Freeing up of office space | ✓ | | | | | 1 |
| More time with family | | | ✓ | ✓ | ✓ | 3 |
| Total | 2 | 1 | 2 | 2 | 2 | 9 |

Table 8.12. Perceived disadvantages of working from home

| | CSA-1 | CSA-2 | CSA-3 | CSA-4 | CSA-5 | Total |
|------------------------------|-------|-------|-------|-------|-------|-------|
| Isolation | | ✓ | ✓ | | ✓ | 3 |
| Longer working hours | | ✓ | | | | 1 |
| Lack of motivation | | | | ✓ | | 1 |
| Lack of suitable environment | ✓ | ✓ | ✓ | | | 3 |
| No boundaries Home/Work | ✓ | | | ✓ | ✓ | 3 |
| Total | 2 | 3 | 2 | 2 | 2 | 11 |

From the above:

Result CS-A.34: ALTERNATIVE WAYS OF WORKING: Q30: All participants (5) identify "Less commuting time" as an advantage of working from home. "More time with family" was identified by the majority (3) of participants as an advantage of teleworking, whilst only one participant considered "freeing up of office space" to also be an advantage.

Result CS-A.35: ALTERNATIVE WAYS OF WORKING: Q30: *“Isolation”, “Lack of suitable environment”* and *“No boundaries between home/work”* were identified by 3 participants (not the same ones) as disadvantages of working from home. One participant (not the same one) identified *“Longer working hours”* and *“Lack of motivation”* as disadvantages of working from home.

Result CS-A.36: ALTERNATIVE WAYS OF WORKING: Q30: Overall, more disadvantages (11) were identified over advantages (9) of working from home. All options from disadvantages were selected at least once by one participant, whilst two options from advantages were unselected.

8.4 SUMMARY

Case Study A analyses a purpose designed contemporary office environment.

This case study produced a total of 36 results, from which 12 are from Office Environment, 8 Work Habits, 6 Organisation context, 3 Technology, and 7 Alternative Ways of Working. The discussion of these results, together with those obtained by the survey and other case studies, is done in Chapter 11.

CASE STUDY B

CHAPTER

9

9.1 INTRODUCTION

This chapter documents a case study on an office-like environment hosted in a virtual world. This case study differs from the other two in this research (CS-A and CS-C) in that it is based on two companies: the developer of the collaboration environment in the virtual world and the user of such technology. It also different because it took place in the UK and required elaborated planning as previously discussed in Chapter 6.

This chapter is composed by three sections. The first section discusses the implementation of the case study and details the specific data collection methods used. The following section is a review of the company developing the virtual environments and provides the context of the technology. The next and final section of this chapter is based on the user of the technology.

9.2 CASE STUDY IMPLEMENTATION

This case study is based on two companies:

- **Company A¹:** The technology developer. This company develops virtual world environments hosted in Second Life (refer to Chapter 2). Company A presented their technology at WorkTech 07 Conference in UK (refer to Chapter 1). This company agreed to have a case study done on their technology as part of this research and nominated one of their clients (Company B) to complement the study.
- **Company B:** The technology user. Company B is a marketing firm based in Manchester.

Table 9.1 shows the research instruments applied and the data collected from each company.

Table 9.1. CS-B data collection methods.

| | Survey | WSD | Floor plan | PDF-form Questionnaire | Face-to-face interview | Office visit |
|--|--------|-----|------------|------------------------|------------------------|--------------|
| Company A Technology Developer | - | - | | ✓ | - | - |
| Company B Technology User | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

As per the above table, information from Company A was collected through the PDF-form questionnaire included in Appendix 6c. The PDF-form together with the Preliminary Case Study Protocol, were emailed on the 30th of July 2008 to the General Director of Company A.

¹ As per RMIT University Ethics requirements the names of the companies are concealed. Companies participating in this case study are referred to as Company A and Company B.

It was expected that the *xml* file (file with the answers to the PDF form) would be emailed back by the 11th of August. However, the due date was missed and a reminder (email) was sent on the 12 of August. The file was received the following day.

The above-mentioned PDF-form included a section for Company A to nominate one of their clients using their virtual world collaboration technology in order to do a case study on them. They nominated a marketing company based in Manchester (Company B).

Next, the preliminary Case Study Protocol was emailed to the Managing Director of Company B on the 18th of August 2008 together with probing questions aimed to develop the final case study protocol. The *xml* file was expected to be emailed back by the 27th of August. Despite various reminders the *xml* file was never emailed. As a consequence, the protocol could not be finished prior to the meeting scheduled on the 5th of September 2008 at their Manchester office.

During the visit to Company B, the Managing Director as well as the Creative Director gave various presentations about Second Life, including the Managing Director's own virtual home and a motorcycle stadium developed for one of their clients. The directors also commented on how social networks (e.g. Facebook) are opening new opportunities for marketeers. The visit lasted 3.5 hours. The following documents, authored by the company, were handed out during the visit:

- The Marketer's Guide to Web 2.0 / Understanding and exploiting the new dynamics of web marketing; and
- Opening an Office in Second Life

Following the interview, the researcher created an avatar in Second Life and was granted access to Company B office hosted in Second Life.

9.3 COMPANY A: THE TECHNOLOGY DEVELOPER

9.3.1 Company overview

Company A is a joint venture between two UK based companies. These two complementary organisations have similar cultures and share a vision of how Second Life can be used for work, leisure and commercial purposes. Company A was set up in 2007 to capture the benefits of virtual worlds and to promote these to the public and private sectors.

The number of staff hired by the joint venture is 10 (8 by one of the joint companies and 2 by the other) although the number can, and often is, supplemented by third party personnel.

9.3.2 Services

Following the strap-line: "*helping you to build your Second Life*", Company A offers various service within the virtual world marketplace; some are already produced (e.g. Events Arena and Learning Modules) and others in development (e.g. Tourism and e-Commerce Platform for goods in Second Life) as at late 2008.

A popular service is SP Events/Events Arena, where an event is created in Second Life by building a venue and creating avatars. Since 2007 Company A has been providing this service to replicate/complement real life events such as award ceremonies, seminars or classical music concerts.

Table 9.2 shows two examples of virtual environments developed by Company A.

Table 9.2. Virtual environments developed by Company A

| | |
|--|---|
|  | <p>Royal Liverpool Philharmonic Orchestra (RLPO)</p> |
|  | <p>The Professional Association of Diving Instructors (PADI)</p> |

9.3.2a SP Collaborate

SP Collaborate is a service that brings people and organisations together virtually. It was estimated by Company A that half of its clients use SP Collaborate.

One type of work collaboration that has been successfully replicated by Company A are meetings:

“We provide a platform for organisations to hold online interactive virtual meetings. By using this service organisations can hold meetings where people from all over the world can attend without incurring huge costs and the inconvenience of travel. It also provides a more personal environment than the one that can be achieved via email or video conferencing”.

Result CS-B.1: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Hosting meetings in virtual worlds can reduce travelling costs and inconveniences whilst providing a better collaboration environment than video conferencing.

9.3.3 Price strategy

Company A charges a fee for the development, setup and operation of the service based on the scope and requirements of the client. This includes elements such as buildings, land

rental during the build period, training and project management. There are also optional services that the company offers to its clients such as ongoing land rental, which varies but tends to be around £200 per month and operational management service at around £100 per month. All fees are real fees subject to real life parameters in terms of taxes, company and commercial law, refer to Chapter 2.

Result CS-B.2: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Virtual worlds are subject to real life expenses in terms of taxes and must adhere to company and commercial law.

Additional training sessions, based on a day rate charge, are offered. The level of training needed is often dependent on the confidence of the end users.

9.3.4 Clients' profile

Company A claims that there is no typical client who is interested in virtual worlds. The company has clients from various industries from both the public and private sectors. Based on Company's A experience marketing firms (like Company B) are receptive and appreciate the benefits of virtual worlds for promoting new products and services for their clients. Likewise, local councils see virtual worlds as a new dimension and an innovative channel for engaging with some of their harder to reach residents/businesses.

Result CS-B.3: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Organisations from various industries across public and private sectors can benefit from virtual worlds.

9.3.5 IT Requirements

9.3.5a Hardware

The hardware requirements for running the services provided by Company A are similar to the ones described to access Second Life in Chapter 2. Company A suggest a computer, typically less than 2 years old (as at 2008), with a reasonable graphics card, processing power and memory. Full voice collaboration requires audio input (microphone) and sound (speakers).

9.3.5b Software

Given that their services run over Second Life, the client needs to download the free Second Life viewer, refer to Chapter 2.

The company noted that this software is just for Second Life applications, and they are evaluating other virtual world platforms with less special hardware and software requirements.

Result CS-B.4: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: It is currently necessary to download a free software (Second Life viewer) to run Company's A working environment. However, this requirement might not be necessary in future developments.

9.3.6 Benefits

Company A sees virtual worlds as a new and innovative delivery channel for engaging a wider audience. They believe that '*in-world*' (term used in the industry to refer to the virtual world) environments allow participants to eliminate geographic boundaries, reduce real-travel and thus support the green agenda. Virtual worlds are viewed as a more relaxed

environment to communicate with others via individual virtual representations called avatars.

Interaction with other avatars and the surrounding is in real time and communication can be done via a keyboard and/or voice.

Result CS-B.5: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Virtual worlds can reduce real travel by eliminating geographic boundaries.

Result CS-B.6: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: In-world communication can be done via keyboard inputs and speech.

9.3.7 Views on work and technology

Company A philosophy is that technology is instrumental to society and sees technology as an enabler, rather than a solution. The company believes that virtual worlds can provide a new work environment and ethos that simplify communication and coordination of information.

Company A believes that virtual worlds have the potential to redefine the way we work, and will in time overtake, or at least complement, other platforms such as current video conferencing, and face-to-face meetings.

Whilst Company A does not consider itself to be an authoritative source on what the office of the future will be, it does believe that virtual worlds have a part to play in the future of the office and sees itself as developing environments complementary to the office of the future. Virtual worlds align with the green agenda and help facilitate teleworking. However, for virtual worlds to prosper as alternative working environments the office of the future will need to be online and dependent on fast broadband connectivity, which most already are.

For those employees for whom working at home is not a viable solution, the developer's company believes that there will be general purpose offices local to where the employees live where they can access data and tools necessary to undertake their day-to-day work in a secure and speedy manner.

Based on the above:

Result CS-B.7: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Technology is instrumental to society.

Result CS-B.8: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Virtual worlds can provide a new work environment and culture which simplify communication and coordination of information.

Result CS-B.9: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Virtual worlds have the potential to redefine the way we work and could overtake videoconferencing and face-to-face meetings.

Result CS-B.10: ALTERNATIVE WAYS OF WORKING: [Company A|PDF-Form]: Virtual worlds have the potential to host the office of the future.

9.4 COMPANY B: THE TECHNOLOGY USER

Company B met Company A when the former requested the latter to develop an ‘*innovative*’ virtual world presence (motorcycle stadium) for one of their key blue-chip clients. Subsequently, Company B commissioned Company A to develop an office presence in Second Life to coincide with a physical move to new offices.

9.4.1 Data quality

Table 9.1, above, shows the various means by which data for this case study were collected. The variety of the sources and the type of data received required more planning and coordination than any other case studies. Still, the main problem with the data in this study was the delayed return of the surveys and WSDs by Company B.

The distant geographic location (and different time zones) between Melbourne and Manchester, together with the company’s ‘*most successful and busiest end of year ever*’ made communications with the Managing Director of Company B very difficult. Whilst the Surveys and WSDs were expected to be returned by November 2008, it was not until the 14th of January 2009 that the package of surveys and WSD were received.

To ensure the accuracy of the data inputted into the system, the double-input process as explained in Chapter 7 was implemented on the questionnaire and WSD. However, as per in CS-A this was done using only one person’s input (input A1 and A2) and the input time was not monitored nor the number of errors recorded.

There were some minor errors in the labelling of the questionnaires and WSD and some questions were either un-answered or answered with multiple options, refer to Appendix 9a. However, these few instances do not have a serious effect in the analysis.

9.4.2 Company overview

Company B is a marketing agency founded in 1994 which has offices in Manchester (headquarters) and London, UK. The agency produces B2C (Business-to-Consumer/Customer) and B2B (Business-to-Business) online and offline communications for a variety of clients in IT, retail, home shopping, public sector and charities amongst others.

The agency was visited on the 5th of September 2008 at the time that it was about to move from their CBD office, close to the Manchester Piccadilly train station, to new offices at The Quays area, approximately 5km West from their location at the previous location.

The company has 36 full time employees, comprising half ‘creatives’ (term used by the industry to refer to designers) and half account managers (the link between the client and the creatives).

9.4.3 Participants background

As requested on the case study protocol, Appendix 6c., a total of 6 participants completed the survey and WSD components of this case study. Table 9.3 summarises the respondents’ profile.

Table 9.3. Respondents' profile

| Participant ID | Gender | Age group | User | Position |
|----------------|--------|-----------|------|--------------------------------|
| CSB-1 | Female | 20's | PC | Account manager |
| CSB-2 | Female | 20's | PC | Account manager |
| CSB-3 | Female | 20's | PC | Account manager |
| CSB-4 | Female | 30's | Mac | Designer (Creative) |
| CSB-5 | Male | 30's | Mac | Art Director (Creative) |
| CSB-6 | Male | 40's | Mac | Senior Art Director (Creative) |

From the above table, half of the respondents are PC users (account managers) and half Mac users (creatives). Section 9.4.5 *Work habits* explains the association between PC/account managers and Mac/creatives. All of the account managers are females in their 20's. On the other hand, two of the creatives are males and the age of this group varies from 30's to 40's.

Each of the above participants completed a survey and a WSD for the old office and another set for the new office, adding up to a total of 12 questionnaires and 12 WSD. Refer to Appendix 9b for the Survey and WSD reports.

9.4.4 Office environment

After 10 years of occupying the current office located at central Manchester, the Creative Director believes that *"the office environment does not promote a creative atmosphere, it is not very inspirational and it is very tired."* Therefore, the company wanted to move to a better, more inspiring environment for employees and clients alike: *"when clients come around we want to show them a more creative place."*

Result CS-B.11: OFFICE ENVIRONMENT: [Company B|Interview]: Office environments can be used to promote a creative and inspirational atmosphere.

Result CS-B.12: OFFICE ENVIRONMENT: [Company B|Interview]: Office space can be used to project an image of the company to its clients.

The quality of the space of the new office was perceived as a very important factor by the Creative Director. He believes that the environment must inspire people and make them feel good of being there. He argues that staff from the creative department spend many hours in the office (from 7am to midnight -17hrs- on some occasions) and they are constantly challenging and pushing each other's ideas. As a consequence, he believes that *"the environment needs to give you some space, a sense of freedom. There should be things around you that inspire you, that do not make you feel restricted in any way. You want to feel free; you want your mind to feel free."*

To achieve his ideal environment, the creative director was personally involved with the architects in the design of the new offices. Part of his design brief stipulated that there were to be no walls in the office, apart from the ones required to create two private meeting rooms. He believes open-plan layouts maximise the sense of freedom and flow of natural light. He also requested breakout spaces, delimited by walls less than 1.5m of height.

Result CS-B.13: OFFICE ENVIRONMENT: [Company B|Interview]: Open-plan layouts can promote a sense of freedom inside the office.

Figure 9.1 shows a picture of the old and new offices. The picture on the left (old office) shows the account managers wing, which is made of a rectangular open-plan area with desks. The wall on the left divides the account managers from the creatives which are in a mirror layout behind such wall. The picture on right shows one of the breakout areas of the new office created by a low wall. The new office has a considerable amount of colour, especially red (the company's colour) and yellow.

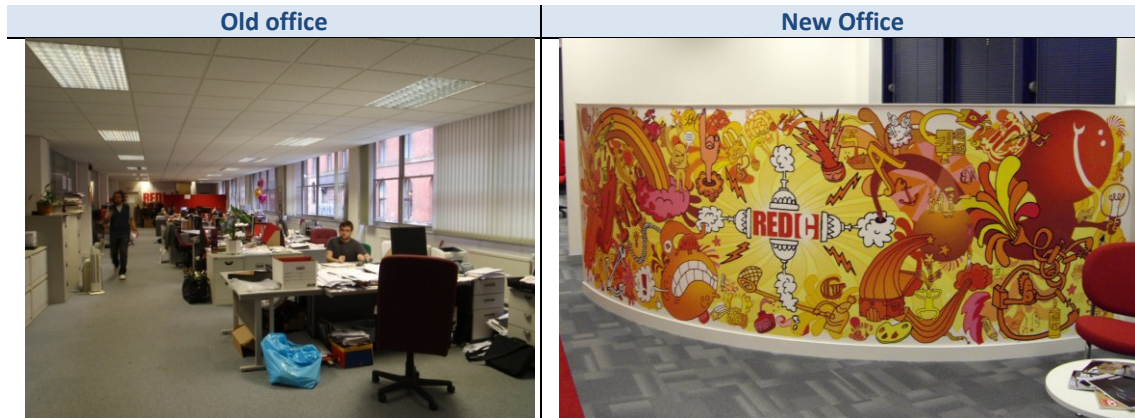


Figure 9.1. Old vs. new office

Both directors are quite satisfied with the colourful '*more inspiring*' environment created in the new office which contrasts with the dull environment of the old office.

Figure 9.2 shows the floor plan of the new office. This figure shows only the left wing of the floor plan where the creatives are located. Account managers are located in an exact mirror layout to the right. The new office layout is similar to the former office and divides creatives from account managers. The open plan layout is fitted with modular workstations.

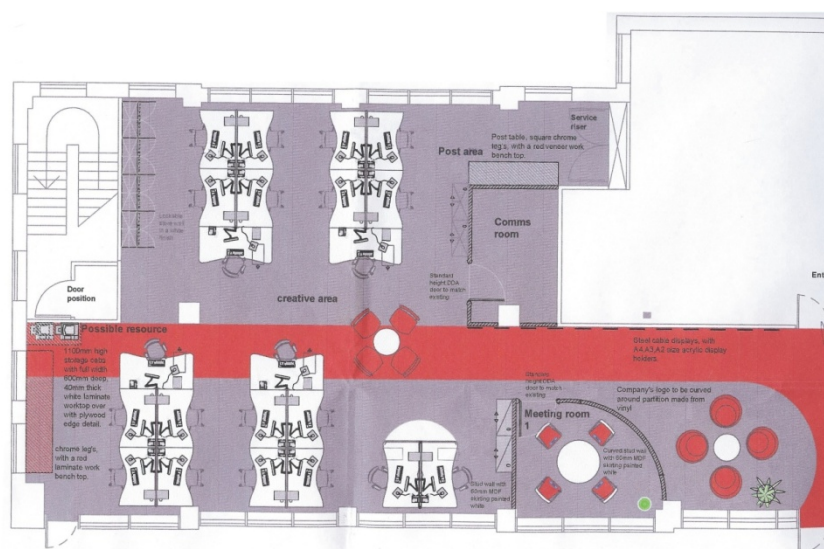


Figure 9.2. New office floor plan

All employees have the same workstation and there are no individual offices. It is thus difficult to spot the '*General Manager's Office*' or better said, workstation. The above layout does not reflect hierarchy.

From the above:

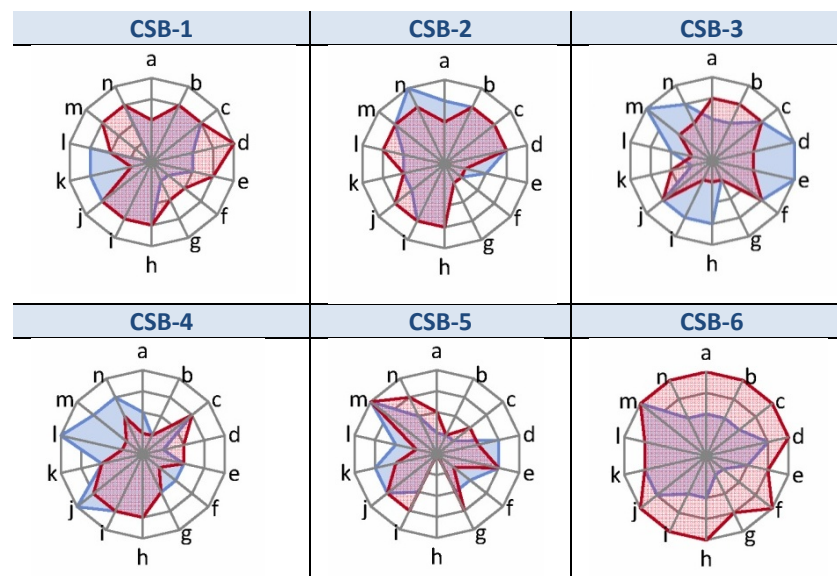
Result CS-B.14: OFFICE ENVIRONMENT: [Company B|Floor Plan]: The new floor plan office keeps the division between creatives and account managers as well as the open plan layout of the old office.

Result CS-B.15: OFFICE ENVIRONMENT: [Company B|Floor Plan]: Regardless of the profession (creatives/account managers) or position (senior management/other) employees work in the same type of workstation.

Result CS-B.16: OFFICE ENVIRONMENT: [Company B|Floor Plan]: The floor plan does not reflect hierarchy.

Table 9.4 plots the level of office environment satisfaction across respondent. The blue area (back layer) shows the values of the old office, the red area (front layer) show the values of the new office. As seen on the table below, only one respondent (CSB-6) has a clearly larger red area than blue area, which indicates that the respondent considers the new office better than the old one in terms of the measured office environment satisfaction parameters. Following such respondent, is respondent CSB-1, who perceived improvement in more parameters (d, e, f, g and m), than losses (k and l). On the other extreme, are two respondents (CSB-3 and CSB-4) whose red area is smaller than the red one, indicating that they considered the new office not as satisfactory as the old one in terms of the measured parameters.

Table 9.4. Office environment satisfaction



Key to Chart: a) Temperature comfort, b) Ventilation comfort, c) Illumination comfort, d) Noise comfort, e) Frequency of distractions, f) Visual privacy, g) Voice privacy, h) Spatial arrangement, i) Furniture arrangement, j) Office size, k) Office storage, l) Storage space, m) Space on work station, n) Overall satisfaction

The above suggest that despite the efforts of the architects and creative director to design a better working environment, the new office environment is not convincingly better than the previous office for most of the respondents.

Result CS-B.17: OFFICE ENVIRONMENT: [Company B|Q02|Interview]: Supposedly better designed spaces do not necessarily engender better levels of environmental satisfaction.

9.4.5 Work habits

As previously mentioned in section 9.4.2 *Company overview* the company comprises half creative staff and half account managers. Each group has very well defined responsibilities. Whilst creatives are responsible of producing the design of the marketing material, the account managers are responsible of managing the project and the relationship with the client. As mentioned by the General Manager during the interview, creatives rarely have any contact with clients, they are mostly on their desk and they do not answer phone calls or leave the office. On the other hand, account managers are not directly involved in the design, but are the 'face' of the company and spend most of their time outside with clients.

These two groups also differ in the technology they use: creatives use Mac's whilst account managers use PC's. The relationship between the computer type and the type of employee is so strong inside Company B that they refer to Mac/PC users indistinctively to creatives/account managers. This comparison can be extrapolated to the association between a scalpel and a surgeon or a hammer and a carpenter.

Result CS-B.18: WORK HABITS: [Company B|Interview]: An activity can define a technology as much as a technology defines the activity.

The difference between PC and Mac users is accentuated by a physical separation between them. As mentioned in the above section, in the old office PC and Mac users were separated physically by a wall, in the new office these two distinct groups are also located,

intentionally, in two separate areas. The reason behind this is that each group serves different purposes and performs different activities to achieve them.

During the face-to-face interview the Creative Director mentioned that the main purpose of the creative department is to generate ideas. Usually those ideas are created during various sessions of meetings that can last two or three days just for the development of the concept. During this stage, the creatives develop various ideas very quickly and literally '*stick them on the wall*'. Then, the account managers bring the client in to discuss the initial ideas. After such meeting the client provides feedback and the design is refined. Such process is '*very organic*' and heavily relies on paper. Figure 9.3 shows the papering of walls.



Figure 9.3. Papering of walls

During the interview the Creative Director described the papering process as follows:

"The idea generation process is very organic, it is very intuitive and it can happen so immediately. I can paper a whole room with ideas in a day. The client and I need to be able to look at the big picture and have it all around us and see how the ideas progress. A thing over there [one side of the wall] might spark another idea over here [opposite side of the wall], which becomes an organic natural process. I do not think there is anything paperless that can help us with that."

However, the Creative Director commented that when they move "*down to the Mac*", they can become a more paperless office and everything can be done on PDFs until they get to final proofing design stage. If the design is to be printed, then they need to do prints on the actual paper that it is going to be used. He argues that it is necessary to print the material out in order to see things that are difficult to see in the monitor. "*I think that there are sections of our industry that can become paperless, but there are other processes that heavily rely on paper.*"

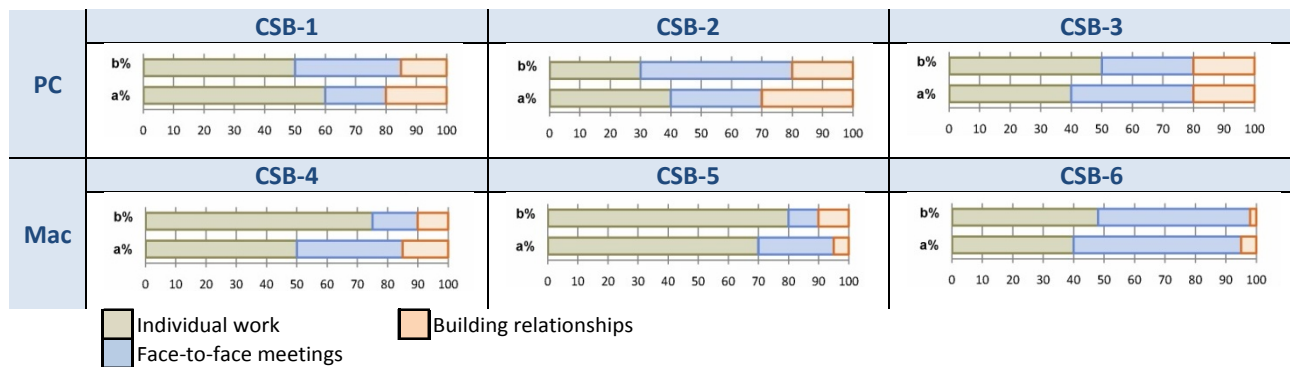
Based on the above:

Result CS-B.19: WORK HABITS: [Company B|Interview]: The organic nature of the design concept heavily relies on paper. There is currently no technology that can match the qualities of paper at the concept design stage.

9.4.5a Working modes (Survey and WSD)

Table 9.5 shows the percentage of time spend by respondents in individual work, face-to-face meetings and building relationships as collected by question 5 of the questionnaire. The bottom bar chart (labelled 'a%') on each group shows the answers provided on the questionnaire administered whilst in the old office, the top bar chart (labelled 'b%') refers to the new office.

Table 9.5. Q05 Survey working modes



From the above it can be seen that PC users (account managers) tend to spend more time building relationships than Mac users (creatives). The highest percentage (80%) of individual work is performed by a Mac user. With the exception of CSB-6 the other two Mac users spend more time doing Individual work than PC users.

A similar trend is also captured by the WSD, see reports on Appendix 9b. For most of the days (Monday to Friday) creatives (CSB-4 to CSB-6) registered 60% or more of quiet solo work. One respondent in particular (CSB-5) registered a full week with 80% in this working mode. On the other hand, account managers are usually at or under 50% of the time doing quiet solo work (with the exception of CSB-01a report, which registered 60%+).

From the WSD data it can also be seen that account managers spend more time communicating via email or telephone than creatives. These results are compatible with the directors' description of each group's activities as describe above.

Result CS-B.20: WORK HABITS: [Company B|Q05|WSD|Interview]: Creatives tend to spend more time doing quiet solo work than account managers.

Result CS-B.21: WORK HABITS: [Company B|Q05|WSD|Interview]: Account managers tend to spend more time writing/reading emails and over the phone than creatives.

Regardless of their position (creatives / account managers), all respondent considered face-to-face interaction, as measured by question 9 of the questionnaire, to be essential (Scale 4) or very important (scale 3), refer to Appendix 9b.

Result CS-B.22: WORK HABITS: [Company B|Q09]: Face-to-face interaction is equally important (Scale 4 and 3) for creatives and account managers.

9.4.6 Technology

According to the responses of the questionnaire, Company B has broadband Internet, wireless network, mostly flat panel monitors, and a website. From the interview, it was clear that both directors see the company, and themselves, as innovators, not only in the adoption of technology required to do their work, but in the services they provide to their clients (e.g. presence in Facebook, Second Life, and other social network).

Result CS-B.23: TECHNOLOGY: [Company B|Q18|Q19|Q20|Q21]: The company has broadband Internet, a website, wireless network and mostly flat panel monitors.

Company B website is more than a promotional site, it has an extensive archive of blogs authored by their employees on marketing and technology covering topics like e-paper, social networks and the future of the Internet amongst many others. Both directors believe that by closely following technology developments they can offer a better service to their clients. This is further explained in the following section.

Result CS-B.24: TECHNOLOGY: [Company B|Interview]: The company's website has a blog discussing marketing and technology topics.

Result CS-B.25: TECHNOLOGY: [Company B|Q18|Q19|Q20|Q21]: Both directors are technology observers and believe that through the use of technology they can offer a better service to their clients.

Based on Rogers (1995) adoption distribution curve (Chapter 2), Figure 9.4 plots the perception of adopter type by respondent.

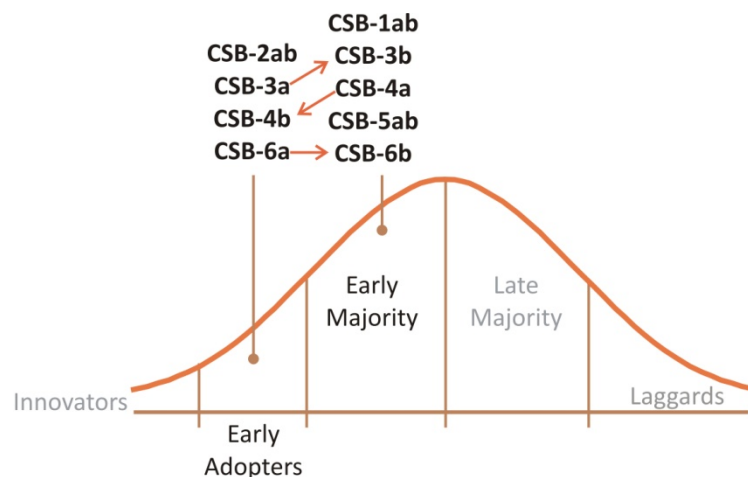


Figure 9.4. Perception of adopter type by respondent

All respondents are within two ranges 'Early adopters' and 'Early majority'. An interesting result is that half of the respondents (3) changed their perception of the company's adopter type after moving into the new office. Two respondents (CSB-3 and CSB-6) went from 'Early Adopters' to 'Early Majority', whilst the exact opposite occurred with one respondent (CSB-4).

Result CS-B.26: TECHNOLOGY: [Company B|Q22]: Participants' perception of the company's type of technology adopter are distributed between 'early adopter' and 'early majority'. Three participants changed their perception following the relocation to the new office, two went from 'early adopter' to 'early majority' and one from 'early majority' to 'early adopter'.

The Creative Director believes that technology allows them to have more freedom in terms of how the space is divided as well as help people working inside to be more mobile. He argues that one thing that technology allows people to do is rethink the traditional office environment and office setup.

"People can get into a pattern with regards to their office environment and continue designing in traditional ways. People sometimes have barriers of thought in regards to how they think about an office."

- Creative Director, Company B

From the above:

Result CS-B.27: TECHNOLOGY: [Company B|Interview]: Technology allows to increase the freedom in terms of how space is divided inside an office and allow people to be more mobile. However, this advantage can be missed by following traditional design paradigms.

9.4.7 Alternative Ways of Working (AWW)

The Creative Director is a 'great believer' in breaking away from the desk and work in breakout areas within the office, as well as outside it. The location of the new office was specifically chosen because of the surroundings.

"There are a lot of benches around the [new] office that are ideal places to reflect. One side of the office looks over the Manchester canal which can be very inspirational in a sunny day. I encourage my creatives to go for a walk and think.... If you have something in your head that you need to get into it, go away from the work environment and go and immerse yourself somewhere where you won't get disturbed."

Equally, however, it is important for the Creative Director to meet deadlines and manage people. He believes that the office is the place to do that.

"I am in the office probably more than I would like to be, but I need to manage people and manage the workflow and manage the work that is going out the door. Ensure that everybody is working and working well. When I do move away I leave action lists with my other managers to take care of things, but equally I encourage them to go away, to breakout, to work from home."

From the above:

Result CS-B.28: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Breaking away from the desk and going to ‘think’ to a more inspirational environment can improve performance.

Result CS-B.29: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: The Creative Director feels that he has to be in the office more than he would like to, to manage staff and workflow.

9.4.7a Second Life

“Imagine a world where you could buy a house for less than £1 and locate it on a sun-drenched beach or a snow-capped mountain, or just park it in the sky. A world where you could build dramatic towering sculptures, design your own fashion accessories and fulfil your creative urges. A world where you could fly, teleport instantly to regions that are changing and growing every day.”

Managing Director, Company B

As marketers, Company B is interested in the opportunities offered by Second Life. In their in-house document “*Opening an Office in Second Life*” the Managing Director notes that more than 300 major brands (including BMW, Vodafone and Coca-Cola) have each created a presence in Second Life motivated by the demographics of its residents. Company B argues that unlike gaming communities (e.g. World of Warcraft) Second Life has attracted well-off, thirty-something, white collar professionals, both male and female, especially from the creative, media and software industries. In marketing terms, a classic ‘early adopter’ profile of influential consumers, which explains why, in his point of view, many major car manufacturers, including Nissan and Mercedes are already in-world.

“I am in the money making business I am making money for my clients and it would be irresponsible of me as a marketer and as a creative director to not look at all new advancements and see how I can exploit them.”

Creative Director, Company B

Result CS-B.30: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Second Life attracts different demographics than other virtual world communities.

Result CS-B.31: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Second Life residents are male and female, well-off, thirty-something, white collar professionals, with a high representation from the creative, media and software industries. In marketing terms, a classic ‘early adopter’ profile of influential consumers.

Result CS-B.32: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Marketing companies are interested in Second Life because of the people it attracts and see it as another opportunity to help their clients make money.

The Creative Director notes that the world of marketing is changing. It is no longer about just press, post and TV. He argues that in the last five years marketing has moved even further with the rise of social networks. Company B is constantly looking how it can, as a marketing company, exploit this environment for its clients' benefit. That was one of the main reasons to explore Second Life: *"the best way to explore Second Life is to have a presence in there."*

Result CS-B.33: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Technologies like social networks and virtual worlds have changed marketing.

The first virtual environment shown during the meeting was the Managing Director's home located in an island.

"The island is quite nice, I always wanted to live in a Mediterranean island. I met quite a few people. Although I lost my next door neighbour! I have been here for 9 months and during that period I have had around 5 or 6 different next door neighbours. It is a more temporary environment than the real world."

Managing Director, Company B

His virtual house is decorated with artwork from previous jobs. He showed his house and referred to each room as if they were real environments.

9.4.7b Virtual office

The objectives set by the company for its office in Second Life are:

- Primary
 - To generate publicity and change perceptions of the company;
 - To upload and showcase the company's work;
 - To accelerate their understanding of virtual worlds; and
 - To provide a virtual meeting space for staff and clients.
- Secondary/Possible
 - To provide an experimental environment for Creatives;
 - To create and sell virtual items; and
 - To offer an in-world advertising service.

Result CS-B.34: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: *"To provide a virtual meeting space for staff and clients"* is one of the primary objectives for creating the company's Second Life office. Other primary objectives include *"to generate publicity and change perceptions of the company"*.

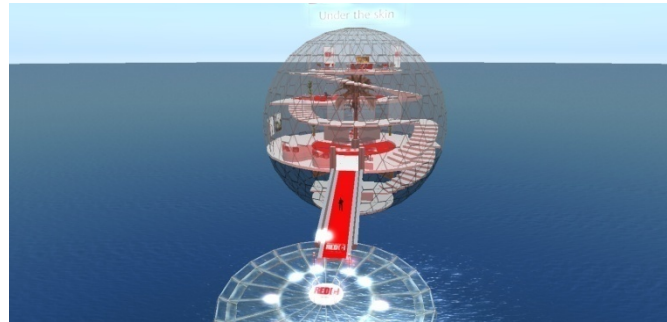
Figure 9.5 shows Company B office in Second Life.

"What I like about our [Virtual] office it is that it is the opposite of replicating a real world office, but still has very good functionality. It has meeting space and presentation areas. So there are some good practical office uses, within an innovative environment."

Managing Director, Company B

External view

The office is a glass sphere suspended over the sea.



Presentation screens

Media (e.g. video, Power Point presentations) can be displayed on the virtual screens. Users (avatars) can watch the presentations whilst sited on the chairs.



Showroom

Marketing material designed by the company is displayed in posters and workstations that can be accessed by visitors.



Breakout area

Avatars can 'chill out' in this breakout area.



Figure 9.5. Company B office in Second Life

From the above:

Result CS-B.35: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: The company's virtual office is a glass sphere suspended over the sea with presentation areas, a showroom and breakout area.

Result CS-B.36: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: What the Managing Director likes the most about the Second Life office is that it is the opposite of a real world office, but still has real functionality including meeting space and presentation areas.

As mentioned by the Creative Director, the company wants to use its Second Life office to work in as well as a marketing tool to clients. However, at the moment it has been more about a marketing tool. Company B is yet to actually use the Second Life office as a working environment. Virtual meetings are the first work collaboration activity it wants to do in its in-world office.

"We have a meeting in London on Thursday and the plan was originally to have one of the account directors who can't join us in London to join us via Second Life. So we would be in real life and this person would join us via Second Life. Unfortunately, that is not going to happen on this occasion, but those are the things that we are looking to do."

Result CS-B.37: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: At the moment, the company is using Second Life office for marketing purposes only and has not been able to use it for work collaboration activities.

Result CS-B.38: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Virtual meetings are the first work collaboration activity that the company wants to implement with its Second Life office.

When further asked why the company has not actually conducted a meeting using Second Life the Creative Director mentioned:

"It might be a generational thing, but you cannot beat a face-to-face meeting or talking to people face-to-face because there are mannerisms in regards to body language and expressions that you cannot get virtually, you've got to be there. Sometimes, while presenting my ideas to the client, I will modify my presentation if I feel that the person's body language is not conducive to what I am saying and they are feeling uncomfortable and crossing their arms, and I might not see that virtually."

Result CS-B.39: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: The incapability of transmitting body language is identified by the Creative Director as the issue preventing virtual meeting to replace face-to-face meetings.

Result CS-B.40: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Adoption of virtual worlds for work collaboration purposes could be accelerated with the introduction of new generations in the workplace.

The Creative Director was made aware of the developing technologies described in Chapter 2 that allow avatars to show emotions and was asked if that would help to improve virtual meetings, to what he responded:

“Yes, unless your avatar is directly linked to your emotions, to your thoughts to your feelings, rather than you pushing a button (key) ‘make my avatar smile’, even though I am not smiling. Your avatar must reflect your emotions without you being able to modify them.”

Result CS-B.41: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: The capability of avatars to transmit emotions could improve communication in virtual worlds. However, for this to be successful, the avatar must transmit the true emotions of the user without the latter having any control over them.

The Creative Director believes that there are other real-world characteristics that cannot be simulated in virtual worlds.

“I feel that people are able to express themselves and understand each other better in real world interaction. For example the way that I judge people when I meet them face-to-face is through a hand shake.... I will be more confident having an initial face-to-face meeting and then saying ‘Ok, from now one we are going to meet virtually’, because we already met.”

Result CS-B.42: ALTERNATIVE WAYS OF WORKING: [Company B|Interview]: Virtual worlds cannot transmit all the information we use to establish a connection during face-to-face meetings.

9.5 SUMMARY

Case Study B reviews office-like collaboration environments hosted in a virtual world as possible solutions to host the office of the future.

This case study produced a total of 42 results, from which 7 are from Office Environment, 5 Work Habits, 5 Technology, and 25 Alternative Ways of Working. The discussion of these results, together with those obtained by the survey and other case studies, is done in Chapter 11.

CASE STUDY C

CHAPTER

10

10.1 INTRODUCTION

This chapter provides an insight view to the motivations, context and challenges faced by a manager in a government organisation who has considered working from home and currently is hot-desking. The study is based on the survey, the Work Sampling Diary (WSD) and a face-to-face interview with the case study participant.

The first part of this chapter documents the implementation of the case study. The second part is the case study analysis, which follows the same structure as previous chapters. Like in CS-B (Chapter 9) comments from the interview are analysed and scattered through the analysis as applicable.

10.2 CASE STUDY IMPLEMENTATION

A specific case study protocol was developed to best address the specific circumstances of this case study, refer to Chapter 6. As per previous case studies (CS-A and CS-B) the survey and WSD were applied and as in CS-B a face-to-face interview was also done. For the latter, an interview agenda was developed and is included in Appendix 6d.

The survey and WSD were e-mailed to the participant in PDF format on the 3rd of December 2008. The PDFs were then printed and completed by the participant and handed back during the interview. The WSD covers the week from the 8th to the 14th of December 2008.

The face-to-face interview took place on the 19th of December 2008 at a venue nominated by the participant near her workplace. The Ethics form used in previous case studies (refer to Appendix 6.c) was signed prior to the interview. With the participant's consent, the interview was recorded (audio only) and later fully transcribed for analysis. The complete transcription is not included to ensure the confidentiality of the respondent. The interview lasted 46 minutes.

10.2.1 Data quality

The quality of the data collected by this case study was very good. All the questions were properly answered and were able to be used for analysis. However, and although the participant considered the study week to be a '*fairly representative week*', there are some activities registered on the WSD that were specific to the time of the year (e.g. "*my lunches were longer than usual due to Christmas shopping*").

To ensure the reliability of the data inputted into the analysis system, the double-input process as explained in Chapter 7 was implemented, but no tracking of errors was done.

10.3 CASE STUDY ANALYSIS

This case study differs from all previous data collection efforts in that it is the only one with a single participant. Thus, the analysis is done in a slightly different fashion (no statistical or

comparison analysis between respondents can be done). However, the analysis follows the same structure as previous case studies.

10.3.1 Participant's background / General demographics

Case Study C participant is a 33 year old female, professional, married to a same-age engineer. They have a 2 year old daughter and are expecting a new baby by early 2009. They share a home 110 km Southeast from Melbourne's CBD.

The participant works at a regional office of a commonwealth government department with 151+ employees (the maximum scale in the survey) across the department, and approximately 55 employees at her regional office. The department focuses on processing applications on behalf of clients. She has been working for this organisation for approximately 8 years and is currently at the management level overlooking staff that are processing client applications. Her office is responsible for processing applications rather than policy-making.

In 2005 the participant considered the option of working from home to reduce the long commuting time (up to 5 hrs per day). However, she found the requirements set by her public employer organisation to be '*too onerous*'. Such requirements included a dedicated room to work and store client information as well as installing particular locks on the windows and doors. These, plus dedicated (separate) PC and Internet access, requirements are further discussed in section 10.3.6b *Home Based Working (HBW)*.

Since the participant worked part-time during 2008, the duties normally given to someone at management level were not given to her and thus she was mainly involved in managing small projects on behalf of other managers. She acknowledges that there have been difficulties in accommodating her needs as a part-timer and her role has been basically custom developed for her.

10.3.2 Office environment

Despite the building being designed for the organisation's activities, the participant considers her office environment satisfaction poor and ranks it lower than the median of the responses obtained by the survey in Chapter 7.

The participant ranks the open-plan layout poor (Scale 1) on parameters: *a) Temperature comfort*, *f) Visual privacy* and *g) Voice privacy*. Parameters which ranked the highest (Scale 4) are: *d) Noise comfort*, followed by *e) Frequency of distractions* (Scale 3). All other parameters ranked unsatisfactorily (Scale 2).

Figure 10.1 shows the level of satisfaction across the parameters of question 2.

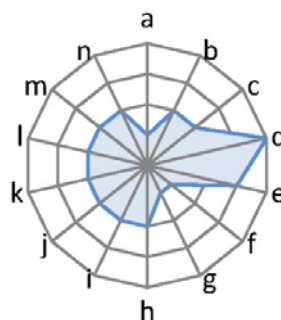


Figure 10.1. CS-C participant responses to Q02(a-n)

Implications of the poor perception of the office environment are further commented in section 10.3.6e *The office of the future*.

Based on the above:

Result CS-C.1: OFFICE ENVIRONMENT: Q02: The lowest ranked parameters (scale 1) are 'a) Temperature comfort', 'f) visual privacy' and 'g) voice privacy'.

Result CS-C.2: OFFICE ENVIRONMENT: Q02: The highest ranked parameter (Scale 4) is 'd) Noise comfort'.

10.3.3 Work habits

The participant works as a manager overlooking staff. Since 2008 she has been working three day a week. She averages 25 hours per week (just over 8 hours per day), never works on weekends, but occasionally takes work home. Although she reported to be happy with her work/life balance, this is just the case since she started working part-time. On the other hand, whilst she considers that being part-time is 'great' for work/life balance, it is not so for her career because her role as a manager has been limited.

The participant considers that part-time work as well as teleworking considerably hinders someone's career and people working under this scheme can miss promotions and other opportunities.

"In some ways my husband and I decided that sacrificing my convenience and career would be okay just for this year because I am part-time anyway. If I were under a different phase of my career that arrangement would not work. I would not see working from home or working part-time as an option for someone that is just starting."

From the above:

Result CS-C.3: WORK HABITS: Interview: Working part-time as well as teleworking can hinder career development. Neither is recommended for commencing a career.

The participant feels a greater duty to perform than full-timers in order to make her managers feel good about employing her as a part-timer, an arrangement they were initially resistant to. She also believes that home-based work (the term used at her organisation for teleworking) would add another barrier for managers and she would then feel the need to work even harder, with a greater duty, to produce tangible work to compensate for their reservations about a more controversial arrangement.

Result CS-C.4: WORK HABITS: Interview: Working part-time promotes the feeling of working harder than full-timers in order to compensate for possible reservations of supervisors. Teleworking is seen as a more controversial arrangement than working part-time and further exacerbates this feeling.

Formal and informal face-to-face meetings are an important part of the participant's activities. Whilst she argues that formal meetings could be done via teleconference, informal meetings deals with issues as they arise. In terms of the latter, it is common that the participant is walking past someone's office and she thinks of something and informally

discusses it. It is in fact this interaction that in her opinion triggers the ‘*need for meeting*’, and thus cannot be done remotely (e.g. video conference).

“Most of my team sits on the first floor and because sometimes I sit on the ground floor, I notice that on those days I am involved in a lot less conversation; because people just don’t go past me or I go past them.”

Whilst the participant considers that being at the office promotes this type of ‘*casual interaction*’, she believes that the meetings could be more efficient if she would not have people in the next cubicle, because then she would need to think more on how to handle them.

“If I had to think strategically who I am going to talk to and what I am going to discuss each day, I would be more efficient and I could even do it from home.”

From the above:

Result CS-C.5: WORK HABITS: Interview: Being at the office promotes casual work related interaction with workmates. Since this interaction arises randomly and out of an impulse it might not be as effective, or necessary, as if carefully planned and addressed during a formal meeting.

As reported on the WSD the participant worked almost 6 hours on Monday, 8 hours on Wednesday and nearly 9 hours on Friday. The lower hours registered on Monday were due to a power failure at her workplace. Refer to WSD Report, Appendix 10a.

Based on the survey, the participant approximately spends 45% of her time doing ‘*Individual work*’, an equal percentage doing ‘*Face-to-face collaboration*’ and 10% ‘*Building relationships and socialising*’. As per the WSD, the participant spends on average an approximate 30% of her time doing ‘*Quiet solo work*’, 28% in ‘*Face-to-face meetings*’, 5% on the ‘*Telephone*’, 17% reading/writing ‘*Emails*’ and 20% ‘*Outside the office*’. Refer to Figure 10.2.

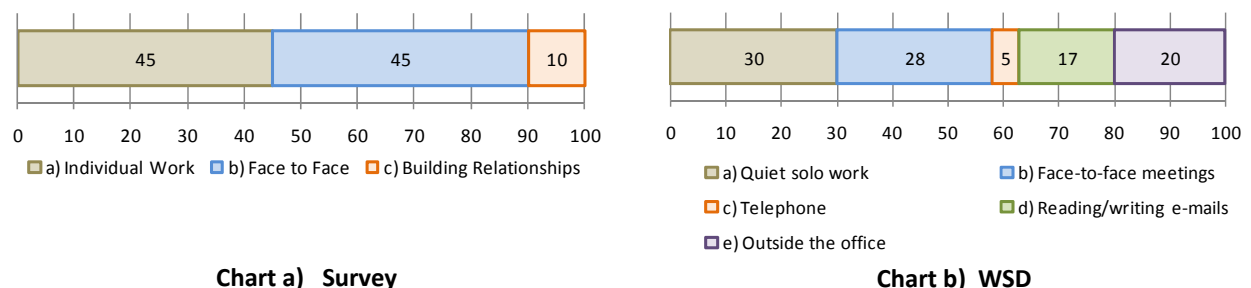


Figure 10.2. Percentage of time spend in various working modes based on a) Survey and b) WSD

Result CS-C.6: WORK HABITS: Q05: The participant spends 45% of her time doing ‘*Individual work*’, 45% on ‘*Face-to-face collaboration*’ and 10% on ‘*Building relationships and socialising*’.

Result CS-C.7: WORK HABITS: WSD: The participant spends 30% of her time doing 'Quiet solo work', 28% on 'Face-to-face meetings', 5% on 'Telephone', 17% on 'E-mails' and 20% 'Outside the office'.

The participant "completely depends on a computer and Internet to work". She uses a multifunction device that prints, scans, and faxes for her daily activities.

Result CS-C.8: WORK HABITS: [Q17|Q12|Interview]: The participant completely depends on ICT to work.

The respondent's definition of work is:

"Work is to produce something for a specific purpose and in many cases you get paid for it. You can work without being paid. I do some volunteer work and I also think that being a parent you feel that you are working all the time and you do not get paid. On balance, work is something you have to do as opposed to something that you want to do."

Result CS-C.9: WORK HABITS: Interview: Work is a paid or unpaid activity done to satisfy a specific objective. Overall, work is something that needs to be done as opposed to something that someone wants to do.

The respondent's main job is to manage and process information as well as oversee people making decisions. Whilst she argues that being in an office building promotes personal interaction which helps overseeing people, the act of processing information could be done, from a technological point of view, from any remote location outside the office environment.

The preferred place for work related interaction at the respondent's workplace is the meeting room.

During the interview the participant was asked why she needed an office to work, to which she responded:

"It is about having a clearly defined space to do my work. I realised that when I am home, my daughter wants to sit on my lap, play with the keyboard, the mouse and that kind of things; so in a way coming to the office is a break from those things."

In these terms, the office is as much about what it has (e.g. equipment) as what it does not have (e.g. distractions). The result of both is an environment conducive to work. As a consequence, the participant feels that she is more likely to finish her daily work at an office like environment than at home.

From the above:

Result CS-C.10: WORK HABITS: Interview: The office provides a defined space to work without the distractions of other environments. It also promotes work related interaction by gathering people working towards a common objective.

10.3.4 Organisation context

10.3.4a Time and place flexibility (Q7 and Q8)

Even though the participant's organisation offers options to work at flexible hours (time flexibility) and from home (place flexibility), see section 10.3.6 Alternative Ways of Working, she ranks the organisation's time and place flexibility low (Scale 1). A plausible explanation for this is that flexible working at the participant's organisation is a right needed to be earned through work performance and requires a long and bureaucratic process to be granted.

The participant made the comment during the interview that due to security concerns regarding the confidentiality of information, the organisation is more flexible about the time when people work than the place where they work.

10.3.4b Level of bureaucracy (Q10)

The respondent considered the level of bureaucracy at her workplace to be high (Scale 4). Examples of this are further given in sections 10.3.6b *Home Based Working (HBW)* and 10.3.6e *The office of the future*.

10.3.4c Competitiveness at the workplace (Q11)

The respondent considered the level of interpersonal-competitiveness at her workplace to be high (Scale 3).

10.3.4d Green policies (Q26)

Whilst the participant's workplace has policies to reduce the use of water and paper, she mentioned that these policies are not properly promoted or monitored and thus, they are not followed. In regards to the paper policy the participant commented: "*we have the technology to do double-sided printing, but hardly anyone uses it.*"

Result CS-C.11: ORGANISATION CONTEXT: [Interview|Q26]: For workplace policies to be successful it is necessary, but not sufficient, to provide the technology required to implement them. Policies need to be promoted and monitored for them to be successful.

Her workplace does not have policies to reduce the use of water or cars.

Result CS-C.12: ORGANISATION CONTEXT: [Interview|Q26]: The participant's office has policies to reduce the use of water and paper, but they are not properly followed.

Currently, the participant has to print documents (e.g. budget spreadsheets) that she needs to discuss during meetings. Thus, she believes that adding network terminals to meeting rooms can reduce printing. The same result could be achieved with a wireless network, with the added advantage of accessing information anywhere in the office.

Result CS-C.13: ORGANISATION CONTEXT: [Interview|Q26]: Wireless networks can reduce printing by allowing access to documents anywhere in the office.

The case study participant feels that, other than when she prints clients' letters, she prints '*very little*' and believes that her workmates print '*a lot more*' than her.

10.3.5 Technology

The following result summarises the technology results obtained by the survey.

Result CS-C.14: TECHNOLOGY: [Q18|Q19|Q20|Q21|Q22|Q23|Q24|Q25]: The participant considers her organisation to be *Laggards* in terms of technology adoption. Nevertheless, her office has broadband Internet connection, web presence, have only flat-panel monitors, rely on e-mails over fax to communicate and hardcopy documents are scanned, but there is no wireless network.

The respondent argues that there are cultural factors from the organisation clients that affect the rate of technology adoption. She commented that one of the department's agendas over the last five years was to develop a system whereby clients could lodge their applications online. Such initiative was pushed even stronger a few years ago. However, a study revealed that the majority of their clients '*trust*' more face-to-face communication and preferred handing their application to a person. On the other hand, as she mentioned: "*this is likely to change when people become more comfortable using an online process. Our younger clients prefer to communicate by e-mail.*"

Result CS-C.15: TECHNOLOGY: [Q22|Interview]: Cultural factors from the organisation's clients, like preference of face-to-face interaction over online communication, have slowed down the organisation's rate of adoption of technology.

Result CS-C.16: TECHNOLOGY: [Q22|Interview]: Younger generations can speed-up the adoption of new technology.

Further insightful comments on technology as well as a plausible explanation to the respondent's poor perception of the organisation's adopter type are done in the following section.

10.3.6 Alternative Ways of Working (AWW)

The participant's organisation has implemented hot-desking (especially for part-time workers) and has a comprehensive policy for what they call HBW (Home Based Work), referred to in this research as Teleworking. The organisation also has the option of doing VWH (Variable Working Hours). Following is a review of these options.

10.3.6a Hot-desking

Given that the participant works part-time (3 days a week), she does not have a desk for herself, thus she sits on different desks every day that she goes to work. Following is her routine:

"On Mondays there are no vacant desks so when I arrive to work I go asking if anyone is on leave and I sit on their desk. We are about 55 people working in the office and unfortunately there is always someone sick or on leave. On Wednesdays I share a desk with two other part-timers. That is a desk that is used 5 days a week across three people. On Fridays I sit on a different desk that is occupied by someone from Monday to Thursday, so I cover for her on Fridays. Before this arrangement [working part-time] I had my own desk."

The participant has a small cabinet on wheels, which she pushes around to her designated desk for the day. She feels that she loses time at the beginning and end of each day setting up everything and then putting it away. Many more people at her workplace share desks in this fashion, which could accumulate in a considerable amount of time lost.

Result CS-C.17: ALTERNATIVE WAYS OF WORKING: Interview: Hot-desking can be a source of time loss due to the daily routine of finding an available desk as well as setting up and putting away personal items.

The participant mentioned that she misses having her own personal space: *"I would feel a lot better at work if I had my own space, but I see [hot-desking] as something to be done when you work part-time."* However, because she had maternity leave between when she was working full time (and had her own office) and when she returned part-time (to hot-desking), she did not find such change as *'drastic'* as she would if it had been from one week to the next. Nevertheless, the participant finds this arrangement *'certainly frustrating.'*

Result CS-C.18: ALTERNATIVE WAYS OF WORKING: Interview: Hot-desking can create the feeling of loss of personal space and can be a frustrating experience.

Result CS-C.19: ALTERNATIVE WAYS OF WORKING: Interview: Hot-desking can be perceived as a *'price to pay'* for being a part-time worker.

10.3.6b Home Based Working (HBW)

The main reason that motivated the participant to work from home was the amount of time she spends driving to her office. The respondent's commuting time, including leaving her daughter at the child-care (near the office), varies from 2hrs 40 minutes to 5hrs 10 minutes (refer to WSD). This amount of time is more than half of the time (up to 63%) that she spends working (an average of 8 hours a day). As mentioned by the respondent during the interview: *"working from home offers the advantages of doing more things rather than just sitting in the car."*

Besides the considerable amount of time spend *'sitting in the car'*, the participant is also concerned by the carbon emissions produced by getting to work in such fashion. The estimated amount of carbon dioxide emitted every month is almost half a tonne¹ from her home-work-home routine only.

Result CS-C.20: ALTERNATIVE WAYS OF WORKING: Interview: The respondent's main motivation to work from home was to reduce the amount of travelling (time spend *'sitting in the car'*). The respondent's travelling routine produces an estimate of almost half a tone of carbon dioxide every month and takes up to 5 hours per day.

She has, thus, considered travelling by train. However, the trains *"are 40 minutes apart in the afternoons, they are very crowded and people sit on the floor. On top of that I need to get a pram and a toddler into the train. I cannot afford waiting 40 minutes for the next train with my child at the end of the day."*

Result CS-C.21: ALTERNATIVE WAYS OF WORKING: Interview: Public transport is not a viable way for the respondent to commute to work.

¹ Calculated using 'Vehicle Calculator' developed by Green Pass Australia Pty Ltd (www.greenpass.com.au). The following parameters were used: Vehicle type: Medium (4 cylinders), Fuel: Petrol, Distance covered per day: 80 km per journey x 2(return) = 160km per day, 160 x 3(working days per week) = 480km per week, 480 x 4 (approx. weeks per month) = 1920 km per month. Based on such parameters the calculator estimates that 0.47 tonnes of carbon dioxide are produced every month.

The next possible option to reduce commuting time and carbon dioxide emissions was to work from home, although she would still need to take her daughter to child care.

Putting aside the various OHS and security requirements further explained in the review of the organisation's HBW policy, the respondent had all the technology needed for her to work from home: a computer, a printer and a broadband Internet connection and thus considered this option in 2005.

10.3.6c Advantages and disadvantages of teleworking (Q30)

Based on the questionnaire options, the participant identified '*less commuting time*', '*freeing up of office space*' and '*more time with family*' as the perceived advantages of working from home.

During the interview she mentioned that the main advantage of HBW from the organisation's point of view is the freeing-up of office space. Staff at her workplace are regularly reminded about the cost of rent. Although this is most problematic at the CBD office, they are also experiencing accommodation problems at her regional building. For her '*less commuting time*' was the most important benefit.

Result CS-C.22: ALTERNATIVE WAYS OF WORKING: [Q30]Interview: The respondent identified '*freeing-up of office space*' as the most important benefit of teleworking for the organisation. On the other hand, '*Less commuting time*' and '*more time with family*' were the most important benefits for her.

Result CS-C.23: ALTERNATIVE WAYS OF WORKING: [Q30]Interview: Staff at the respondent organisation are regularly reminded about the cost of rent.

The participant reported '*lack of a suitable environment*' and '*no boundaries between home and work*' to be the disadvantages of alternative ways of working in the survey. Her concern of losing the boundaries between home and work was manifested during the interview and acknowledged that she would need to be "*very disciplined to make it work.*"

Result CS-C.24: ALTERNATIVE WAYS OF WORKING: [Q30]Interview: The respondent identified '*lack of suitable environment*' and '*no boundaries between home and work*' to be the most important disadvantages of teleworking.

Result CS-C.25: ALTERNATIVE WAYS OF WORKING: Interview: Working from home requires discipline to maintain the boundaries between work and home.

Although the participant did not identify '*isolation*' as a disadvantage of working from home on the survey, during the interview she commented feeling isolated as a consequence of working part-time. However, such isolation does not refer to missing out on the social aspect of her workplace, but missing out on important information from a potential meeting held at a time that she is not at the office. This type of isolation could also be extended to HBW.

Result CS-C.26: ALTERNATIVE WAYS OF WORKING: [Q30]Interview: The respondent believes that working part-time can create a feeling of isolation, which stems from missing out on important information.

From the participant's point of view, the risk of staff underperforming is the organisation's main concern (disadvantage). Thus, monitoring teleworkers performance is one of their biggest problems. However, the participant considers that more than a problem of measuring or overseeing performance, it is a 'cultural' problem:

"The culture is the biggest problem [for HBW]. There is the perception that if someone is working from home they are really not working hard."

Result CS-C.27: ALTERNATIVE WAYS OF WORKING: [Q30|Interview]: From the participant's point of view, employee underperformance is the organisation's biggest concern posed by teleworking.

Result CS-C.28: ALTERNATIVE WAYS OF WORKING: [Q30|Interview]: According to the participant, there is the perception that if someone is working from home they are really not working hard. Culture is the biggest problem for implementing Teleworking.

Another concern for the organisation, perceived by the participant, is the privacy and security of confidential information. However, she believes that the culture is different between state departments and the commonwealth. For example the Victoria State Government is more open to remote access than the Commonwealth Government.

Result CS-C.29: ALTERNATIVE WAYS OF WORKING: [Q30|Interview]: Security of confidential information is a concern for implementing Teleworking.

HBW policy review

Following is a review of the organisation's HBW policy. Although the following policy review is done on the updated versions (version 2.0, updated early 2008), the policy is similar to that back in 2005 (used by the participant to make her assessment on telework).

HBW, as stated by the organisation, *"enables employees to balance their professional and personal responsibilities and allows [the organisation] to meet its objectives through increased productivity and the retention of valued employees."*

The organisation offers voluntary HBW as part of its Collective Agreement. The voluntary nature implies that an employee cannot be forced to work from home. On the other hand, employees do not have an automatic entitlement to HBW. This option is barred to casual employees or employees who do not have a satisfactory PDA (Performance and Development Assessment). The applicant must have a current satisfactory PDA rating without having several unsatisfactory PDAs in the past to qualify for HBW.

Result CS-C.30: ALTERNATIVE WAYS OF WORKING: [Policy|Interview]: Teleworking is a right that needs to be earned through satisfactory performance.

Employees that adopt HBW can only work from home up to three fifths of their working week. The remaining two-fifths of their working week must be spend at the office to *"facilitate supervision of their work, ongoing team interaction and attendance at meetings and training."* The participant believes this is a measure to control employees' underperformance as previously discussed in section 10.3.6c Advantages and disadvantages of teleworking (Q30).

Result CS-C.31: ALTERNATIVE WAYS OF WORKING: [Policy|Interview]: Teleworkers are required to spend 2/5 of their time at the office.

Following is a summary of the process required for all employees who wish to do HBW:

- 1) **Apply for HBW.** This application initiates the investigation and assessment of the requirements described below.
- 2) **Satisfy the various HBW requirements.** The minimum mandatory requirements set by the organisation include:
 - a. **The nature of the employee's duty must be suitable for HBW.** Duties that are considered to be suitable for HBW are those which are able to be performed fairly autonomously, require limited client contact, do not involve intensive team work or are easily monitored and measured. Activities considered not to be suitable are those dealing with sensitive secured information, require extensive client contact, involve full-time training, involve supervisory responsibilities or require intensive team work.
 - b. **The employee's home satisfies the Security and OHS assessment.** Since HBW employees need to remove information out of the secured office environment, it is a requirement that a security check is done prior to commence HBW. This assessment includes a physical inspection of the site by the organisation's security or an independent consultant. The applicant can have three different types of remote access from home to the organisation's systems: (i) No remote access, (ii) Remote access with limited access or (iii) Remote access to broader services. Applying for remote access (ii and iii) is a separate process and requires additional security requirements.

The Occupational Health and Safety Act 1991 requires organisations to provide a healthy and safe working environment to its employees, including those working from home. Thus, the home site must comply with the same OHS guidelines as the office site.
- 3) **Make an agreement.** Once the above criteria have been satisfied an agreement is done. The applicant agrees to take responsibility for the security of sensitive material. Thus, children or other family members must not have access to information stored at the home site. The employee must adhere to the organisations OHS policies and report all accidents and incidents. Given that the organisation does not have a duty of care for visitors to the home site, employees are advised to confirm that their insurance will not be affected by public liability coverage. The employee must notify to the organisation of any changes to the home site, including moving, renovations or new housemates. The employee must notify to the organisation in advance if he/she is to be absent from their home office during their agreed working hours. Employees are expected to attend work-related training in the office or in other venues. Since the section of the house dedicated to HBW is considered to be an office, as per government policy it must be smoke free and this space should be accessible (following the appropriate notice) to the employee's manager for OHS inspections and supervision duties.

On the other hand, the organisation will offer HBW employees all training and development opportunities available to office staff (non-HBW). The organisation will also keep informed HBW staff on changes in the workplace including technology, processes and business priorities.

Based on the above:

Result CS-C.32: ALTERNATIVE WAYS OF WORKING: [Policy|Interview]: Duties that are considered to be suitable for teleworking are those which are able to be performed fairly autonomously, require limited client contact, do not involve intensive team work and are easily monitored and measured.

Result CS-C.33: ALTERNATIVE WAYS OF WORKING: Policy: The home site is considered to be part of the office and as such it must comply with the same OHS regulations as the office site.

The above 3-step process has 32 stages (made up by 3 stages for Step 1-Application, 13 stages for Step 2-Assessment, also within this step are 5 stages extra for the security assessment and another 5 for the OHS processes, and finally 6 stages for Step 3-Agreement). The process involves a variety of people including the applicant, supervisor, manager, security advisor, remote access coordinator and OHS coordinator.

The participant knows just one person (whom she helped get through the process) and knows of two others that work from home across the whole organisation in Victoria. None of them are from her office. She believes that the reason behind the low adoption of HBW is that the process is too onerous. As she mentioned:

"I help someone go through that process in 2005 and it took over six months when she first asked to when she actually was permitted to go ahead, because of all these forms and steps and whatever else. She had to get special locks to doors and windows. This is a barrier. Thankfully she persisted."

Result CS-C.34: ALTERNATIVE WAYS OF WORKING: [Policy|Interview]: Getting a teleworking application approved can take over 6months.

However, the participant does not believe that the policy is meant to discourage people. Instead, she believes the policy reflects the requirements considered necessary from the perspective of a very conservative organisation that is resistant to new ideas and change and wants HBW to work. It is also an organisation that has public accountability for the confidentiality of its data.

Result CS-C.35: ALTERNATIVE WAYS OF WORKING: [Policy|Interview]: The onerous requirements and bureaucratic process of the teleworking agreement reflect the reservations of a conservative organisation resistant to new ideas and change.

Parallel to the previously described process and before the HBW agreement is approved, an overall cost/benefit analysis of the proposed HBW arrangement is done. Table 10.1 shows a breakdown of the facilities, equipment and operational costs to be provided/covered by the employee or organisation under the HBW agreement.

Table 10.1. Provision of facilities and payment costs by Employee and Organisation

| Employee | Organisation |
|---|---|
| Equipment and furniture for the home site (e.g. desk, chair, lighting fixtures). | Security and OHS assessment costs. |
| Upgrades to the home site required to comply with security and OHS requirements (e.g. window and door locks). | A workstation (most likely shared) at the organisation's office site. |
| Travel to and from the office based site. | The installation and rental of a second phone line for remote access (if required). |
| Phone calls made from the home site. | Security equipment (e.g. secure briefcase). |
| Lost or damaged equipment provided by the organisation where it is established that the employee has failed to take due care. | Essential stationary and office supplies. |
| Taxation, leasing or mortgage arrangement, utilities and insurance costs. | Appropriate software and hardware computing equipment and its maintenance. |

The factors taken into consideration for the HBW to be approved are divided into cost and benefits as below:

The cost assessment factors taken into consideration include:

- **Setup establishment costs:** This cost includes the organisation's equipment required to set up the home site and to satisfy the above-mentioned security and OHS requirements.
- **Ongoing costs:** This item includes expenses required to perform future security audits in the case that the employee moves residence, performs renovations or has a new housemate.
- **Savings:** The potential cost reduction of maintaining the office site as well as expected reduced absence on leave, is part of the assessment.
- **Productivity:** The extent to which the HBW arrangement will affect team productivity is taken into consideration.

The benefit assessment factors taken into consideration include:

- **Retention of valued employees:** The loss of corporate knowledge (including historical knowledge) and the loss of productivity during training of replacements are factors taken into consideration in the case that the applicant cannot work under other circumstances other than HBW.
- **Savings from shared accommodation:** The organisation considers that hours of a part-time employee and a Home Base worker may complement each other and allow the use of just one desk by two people (hot-desking).
- **Productivity:** The policy acknowledges that HBW could help to increase the productivity of employees that may have to travel long distances to work. Likewise, it can provide extra flexibility to employees during traditional work hours to:
 - Provide intermittent care for dependants: However, it is noted that HBW is not a substitute for child or other dependant care and employees must not provide intermittent care during their agreed working hours. HBW employees must put in place caring arrangements for any dependants requiring care during the employee's nominated working hours.

- Receive intermittent care: However, HBW is not approved if the applicant is unable to meet the two-fifths of the required working hours at the office-based site. The policy does not recommend HBW to employees who are in a graduated return to work program due to a work-related illnesses injury.

The HBW agreement does not proceed if the above cost-benefit analysis is not favourable.

Result CS-C.36: ALTERNATIVE WAYS OF WORKING: Policy: Teleworking is considered to reduce costs of maintaining the site office as well as reduce absence on leave.

Result CS-C.37: ALTERNATIVE WAYS OF WORKING: Policy: Teleworking can help to avoid loss of corporate and historic knowledge by retaining employees that cannot go to the office site to work.

Result CS-C.38: ALTERNATIVE WAYS OF WORKING: Policy: Teleworking can facilitate employees to provide/receive care, but not during nominated working hours.

The organisation continuously monitors the HBW arrangement and reviews it every 12 months in order to assess changes in the employee's duties and the business area of work as well as changes in personal circumstances. Whilst an HBW agreement can be of any duration, 6 months is the recommended minimum due to the costs involved in setting up the arrangement. No maximum time for HBW is specified. Nevertheless, the agreement can be terminated on the 12th month review if the employee receives an unsatisfactory PDA, or if the employee moves to a residence that does not satisfy security or OHS requirements. The agreement can also be terminated by mutual agreement between both parties. The termination process is a 6 stage process (not included in the previous tally) that usually takes 6 weeks.

Result CS-C.39: ALTERNATIVE WAYS OF WORKING: Policy: The minimum duration of a teleworking agreement is 6 months. There is no maximum times specified for doing HBW, but the agreement is reviewed every 12 months.

Result CS-C.40: ALTERNATIVE WAYS OF WORKING: Policy: The HBW agreement can be terminated when the employee receives an unsatisfactory Performance and Development Assessment (PDA), does not satisfy security and OHS requirements or by common agreement.

The policy was not the only factor that caused the respondent to give up home based work. She preferred the day care centres closer to work than the ones available in her area and also wanted her child to have contact with her grandparents, who also live closer to work. Still, she considers working from home in the future and in 2010 she will reassess everything and reconsider.

10.3.6d Variable Working Hours

The organisation also offers its employees the option to work variable hours. As defined by the participant, Variable Working Hours (VWH) refers to the option of people working a standard day, but not every day of the week (like in her case) and people that work outside of normal hours. For example, someone at the participants' office has a daughter that

requires professional care. His official time start is 8am and leaves work every day at 3pm so he can take over from the carer at 4:30pm.

VWH approval must be sought separate from the HBW agreement. The HBW policy makes the distinction between HBW and VWH (Variable Working Hours) and notes that the hours indicated on the HBW agreement do not constitute an agreement to do them under a variables scheme or VWH. It is a requirement that any employee using HBW must be able to be contacted by the organisation at all times during the agreed working hours.

Result CS-C.41: ALTERNATIVE WAYS OF WORKING: [Policy|Interview]: Variable Working Hours (VWH) offers the opportunity to employees to select the days they want to work (in case of part-timers) or work outside the traditional working hours. However, it is a separate and independent application process from HBW.

10.3.6e The office of the future

During the interview the participant was invited to provide her vision of the office of the future. Below is her response.

“My vision would be a place that is physically comfortable, where people have enough space for their body, their papers, their things that they need to store. Where things like temperature and lighting and glare are resolved before the office is built and have comfortable desks and chairs that can be adjusted for each person. Our current office does not satisfy these criteria, even though managers are constantly trying to fix things. I would hope that the office of the future would have more automated processes. I would like to be able to do more things from my computer. For example, I would like to be able to send a fax from my computer, without having to print it first, but [the IT department] haven’t installed that function, I don’t know why.”

Her vision of the office of the future not only includes, but revolves around the three core components of organisations: people, space and technology as discussed in Chapter 2.

It is noticeable that the respondent’s vision still refers to a physical place where people congregate, an office building. When this was highlighted to her she added:

“True. My first thought of the office of the future was an office building, but I think it would include the ability to work from home easily if you wanted to.”

She hopes, however, that by then the shortcomings of workplace architecture will be fixed.

An interesting aspect of her vision of the office of the future is that it has more to do with making today’s office work, than with a futuristic view of the office as described in Chapter 8 (virtual environments) or with implementing technologies like the ones reviewed in Chapter 2.

Result CS-C.42: ALTERNATIVE WAYS OF WORKING: Interview: The respondent’s vision of the office of the future is a well designed and efficient office-like environment with the capability to work from home. However, it is more about making the current office work than a futuristic approach.

The participant was then invited to differentiate her vision between her ideal scenario and the real scenario, the one that she believes will be more likely to happen.

"In my ideal office the IT systems have been designed to complement the process. Instead of, as it has happened, that we need to adapt to the process established by the IT department, rather than the IT department giving us solutions that reflect our processes. My ideal office of the future could be achieved in 10 years."

It is worth mentioning that the IT needs craved by the participant such as databases, Word templates and sending a fax from her computer are within the possibilities of current technology. In this context, the above quote: *"My ideal office of the future could be achieved in 10 years"*, could be interpreted as *"It will take our IT department 10 years to provide a system that complements our processes"* rather than *"it will take 10 years to develop the require technology to achieve my vision of the office of the future."* As she mentioned, the IT department, handled by a contractor located in Canberra, is expensive and difficult to contact and given that they provide solutions for the whole organisation (Australia wide) it can take months for them to fix something.

The above-mentioned disparity between her department needs and the solutions provided by the IT department was constant throughout the interview and was identified as a source of ongoing problems at her workplace. Whilst the participant believes that, ideally, technology should increase efficiency and make life easier, there is the risk that she and her staff end up serving technology. In a specific example given during the interview, they (she and her staff) needed to alter their processes, *"the way we would do it"*, to solve a problem with a Word template inside a database, in order to get the work done. Whilst she believes that they do not work more hours because of the problems of technology, she feels they are not as efficient as they could be.

From the above:

Result CS-C.43: ALTERNATIVE WAYS OF WORKING: Interview: An ongoing problem for the respondent is that she and her staff need to change their processes to suit the technology provided by the IT department rather than the IT giving them solutions that reflect their processes.

The above is a source of further problems. As the respondent commented during the interview, it is expected that technology improves the process it is developed for. Thus expectations rise as the processes is *'supposedly'* improved with new technology, but what really happens is that:

"We have a constant battle with upper management saying: 'why can't you produce more if we have this new technology?' We go back to them and say: 'yes, but there are many bugs [errors] in the new system', or 'the software was designed for something else and it doesn't assist us'. So we are constantly justifying why we cannot meet their expectations. Their expectation is that we are more efficient, when in fact we are less. This is an ongoing issue in our department."

Result CS-C.44: ALTERNATIVE WAYS OF WORKING: Interview: The expectation of improved efficiency created by the introduction of new technology is a source of problems between senior management and staff doing the process when the technology delivered is not properly designed.

The participant was then asked to describe her vision of what she believes will actually happen in the future at her workplace.

“In reality, in my department we will be more and more squashed and it is actually happening. In the CBD office they refitted a floor to fit more people in because rent is very expensive. We now have a lot less space. There is talk of moving areas that do not have face-to-face contact with clients to cheaper buildings in the outskirts of the CBD. But there is resistance to that idea from the union and also because we want to attract good employees and that could be something that prevents someone joining the department. It is still a fairly conservative view.”

Her ‘real’ scenario, which as she mentioned has already started, denotes the preference of satisfying the economic needs over an adequate workplace environment. It also denotes that the location of the building (CBD) is seen as a way to lure talent into the organisation. However, whilst this strategy could get talent in, it could fail to retain staff when they start to suffer the trade of an adequate environment for a CBD location.

Result CS-C.45: ALTERNATIVE WAYS OF WORKING: Interview: The office of the future will more likely have considerable less space as rent becomes more expensive. Comfort will be sacrificed at the expense of location.

Result CS-C.46: ALTERNATIVE WAYS OF WORKING: Interview: Buildings and their locations are seen as asset which can be used to attract talent into the organisation.

10.4 SUMMARY

Case Study C discussed the motivation, context and challenges of an employee of a large government organisation that considered working from home and is currently hot-desking.

This case study produced a total of 46 results, from which 2 are from Office Environment, 8 Work Habits, 3 Organisation context, 3 Technology, and 30 Alternative Ways of Working. The discussion of these results, together with those obtained by the survey and other case studies, is done in Chapter 11.

DISCUSSION OF RESULTS

CHAPTER

11

11.1 INTRODUCTION

Following the mixed method approach described in Chapter 6, this chapter integrates and discusses the results obtained across the survey and case studies identified in Chapters 7 to 10.

Discussion of results is done through a series of arguments developed under the 6 headings used in the survey and case studies: *Demographics, Office environment, Work habits, Organisation context, Technology and Alternative Ways of Working*.

The concepts of People, Space and Technology are individually revisited. Similarly, the People-Space-Technology models reviewed in Chapter 2 are discussed and a revised and expanded model is proposed.

A review of the concept of work is done in order to better understand the possible future of the office.

11.2 INTEGRATION

The survey and case studies produced a total of 297 results as shown in Table 11.1. A compilation of these results is included in Appendix 11a.

Table 11.1. Number of results by topic across the survey and case studies.

| | Survey | CS-A | CS-B | CS-C | Total |
|-----------------------------|------------|-----------|-----------|-----------|------------|
| Demographics | 7 | - | - | - | 7 |
| Office environment | 24 | 12 | 7 | 2 | 45 |
| Work habits | 47 | 8 | 5 | 8 | 68 |
| Organisation context | 29 | 6 | - | 3 | 38 |
| Technology | 34 | 3 | 5 | 3 | 45 |
| Alternative Ways of Working | 32 | 7 | 25 | 30 | 94 |
| Total | 173 | 36 | 42 | 46 | 297 |

A total of 41 results are tested for independence (χ^2 test) in Appendix 11b. From these, 11 results rejected the null hypothesis (showed dependency) at $\alpha=0.05$.

11.3 DISCUSSION

The following discussion is based on 117 results which are most related to the research questions. Following the methodology described in Chapter 6, results IDs are included in parentheses for reference.

11.3.1 Demographics

11.3.1a Gender

Result(s) discussed in section: S.1.

The majority of the survey respondents are males (S.1). According to ABS-1301.0 (2008) the composition of the Australian labour force is influenced by changes in size and composition of the adult population. However, while as at June 2006 the same ABS report reported a sex ratio of 98.8 males per 100 females, the overall employment to population ratios¹ of males is higher than for females. This could be an indication of the prevailing social culture still influencing the workplace, re-enforcing the '*women as carers, men as bread winners*' stereotype (HREOC 2007).

11.3.1b Age

Result(s) discussed in section: S.2.

According to S.2 the majority of respondents belong to Generation X (54%), followed by the Baby Boomers Generation (38%) and Generation Y (8%). This result compares with Sayers (2006) who argues that in 2001 Baby Boomers represented approximately 42%, Generation X 36%, Generation Y 17% and Matures (not represented in this study) 5% of the Australian workforce.

It is stressed, however, that Sayers' estimation was based on a 2001 census. During the six year difference (the research survey took place in 2007) it could be that most Matures and possibly some Baby Boomers have retired. Parallel, Sayers' figures refer to '*Australia's workforce*' failing to specify if it is limited to people working in an office (e.g. knowledge workers). It could be that the Sayers data includes a variety of professions (e.g. tradespersons, transport workers) not considered in this study. In fact, the high percentage of Generation Y (17%), which in 2001 would have been between 7 and 23 years old, suggests that it may include age group '15-19 years' which has a high percentage (36.8%) in '*Elementary clerical, sales and service workers*', but display a considerably lower proportion (1.7%) in the '*Professional*' occupation group (ABS-1301.0 2008).

Since the age group ranges used by the ABS are different than the ones used to group generations (see Table 2.1) it is not possible to directly compare S.2 with the census of '*Employed persons by age group*' as per ABS-1301.0 (2008). Nevertheless, this census shows that the percentage of persons employed as '*Managers and administrators*' (equivalent to Senior Management group in this research) increases with age. In fact, the lowest percentage (0.3%) is registered at the 15-19 age group and then constantly increases until it reaches its maximum percentage (25.3%) at group '*65 years and over*'. A similar phenomenon was observed in this study. A cross-analysis between age group and position (Senior Management / Other) shows that only 2 out of 8 people in their 20's belong to the Senior Management (SM) position group, which contrasts with the opposite side of the age scale where all (8) of the respondents in range 5 (people in their 60's) belong to the SM group.

¹ The employment to population ratio for any group is the annual average number of employed persons expressed as a percentage of the annual average civilian population aged 15 years and over in the same group (ABS-1301.0 2008).

The above is relevant because it suggests that people from older generations are more likely to be the ones making the decisions² in terms of technology adoption. As previously noted by Sayers in section 2.3 *People*, Generation Y considers Baby Boomers less than competent in their use of technology. Moreover, as further discussed in section 11.3.5c *Adopter type perception* younger generations can perceive an organisation's technology adoption type as lower than older generations. This gap in technology understanding and competence could be a possible source of frustration for younger generations in the workplace.

11.3.2 Office environment

11.3.2c Open-plan vs. enclosed / Purpose designed vs. Adapted

Result(s) discussed in section: S.16, S.17, S.18, S.19, S.20, S.21, S.22, S.23, S.24, S.25.

Result S.24 states that adapted buildings and enclosed layouts outperform purpose designed buildings and open-plan layouts. Following is a detailed discussion on this result.

a) Open-plan vs. enclosed

The arguments favouring enclosed over open layouts (S.24) are that enclosed environments have better visual and voice privacy satisfaction than open layouts (S.20 and S.21). Likewise, temperature comfort and general spatial arrangement are also ranked better in enclosed layouts (S.16 and S.23). Parallel, open-plan layouts did not outperform enclosed layouts in any of the parameters measured by question 2 (refer to Table 7.22).

It is important to note, however, that results S.16 and S.23 are within 10% of the margin error set for the study in section 7.2.3 *Statistical representation* and thus are outside the confidence limits established by the study. Parallel, whilst S.20 and S.21 reject the null hypothesis (show dependency at $\alpha=0.05$), S.16 and S.23 do not, refer to Appendix 11b.

Therefore, data collected as part of this study can only conclude that enclosed layouts are considered as better than open-plan in terms of visual and voice privacy (S.25).

Nevertheless, Bodin and Bodin (2008) as well as Lee and Brand (2005) claim that cell offices (enclosed layouts) increase the ability to meet the users' need for personal control over open-plan layouts, refer to section 2.7.4 *Office types*, which then translates into better environment satisfaction. Oommen *et al.* (2008) also identify issues regarding the environment quality of open-plans and favour small, private closed offices instead.

It is thus considered that enclosed office layouts are better than open-plan in terms of environment satisfaction.

b) Purpose designed vs. adapted space

The arguments favouring adapted spaces over purpose designed (S.24) are that the former have better ventilation (S.17), less distractions (S.19) and higher spatial arrangement satisfaction (S.22). On the other hand, purpose designed buildings rank better than adapted ones at illumination (S.18). Refer to Table 7.22. However, S.19 and S.22 are within 10% of the margin error and only result S.22 rejected the null hypothesis.

Therefore, based on the data collected by this study, it cannot conclusively be said that adapted spaces are better than purpose designed buildings. What can be said, however is

² Decision making was the criteria to differentiate between SM and O among the survey respondents, see section 7.4.1d *Respondent's position*.

that purpose designed buildings are not significantly better than adapted spaces in terms of the parameters measured in question 2. This should be a result of interest to architects, as it would be expected that purpose designed buildings (given that they are purposely designed) should outperform adapted spaces in all respects.

11.3.2d Non-hierarchical environment

Result(s) discussed in section: CS-A.4, CS-A.5, CS-B.15, CS-B.16.

A noticeable result in CS-A as well as in CS-B is that both floor plan layouts lack a hierarchy (CS-A.4, CS-A.5, CS-B.15 and CS-B.16). That is, the office layouts do not reflect the status of the occupants. Regardless of their position (SM/O) staff are located in the same open space and have the same modular workstations. It is thus not possible to identify the General Manager's office because he/she works on a modular workstation similar to all other staff located elsewhere in the open layout.

Technology development is further contributing to non-hierarchical environments. Hamel (2009) argues that in the Internet, what counts is not people's resume, but what they can contribute:

"When you post a video to YouTube, no one asks you if you went to film school. When you write a blog, no one cares whether you have a journalism degree. Position, title, and academic degrees—none of the usual status differentiators carry much weight online."

Hamel adds, however, that in the Internet some individuals command more respect and attention than others and thus have more influence. *"Critically, though, these individuals haven't been appointed by some superior authority. Instead, their clout reflects the freely given approbation of their peers. On the Web, authority trickles up, not down."* (Hamel 2009).

This type of 'social organisation' could become common in the workplace when the Facebook Generation ("Generation F") gets into the workplace. A similar forecast is made by Pitt and Bennett (2008) who also believe that traditional benchmarks such as organisation charts, job titles, seniority and cost per employee will no longer dictate workplace design.

Whilst not using space to denote hierarchy could prove to be as beneficial as accepting ideas solely based on their content, this research questions, as further discussed in section 11.3.3b *Working modes, one size fits all?*, that similar spaces (same layout and workstation) can equally satisfy different working modes.

11.3.3 Work habits

11.3.3a Amount of work

Result(s) discussed in section: S.32, S.34, S.35, S.39, S.42, CS-C.3, CS-C.4

Most of the survey and case study respondents work overtime (S.32). One respondent (BC-68) reports working an average of 80 hrs per week, equivalent to more than 11hrs per day (based on 7 days a week³). This indicates that he spends almost half (48%) of the 168 hours in a week (7x24) in an office environment or an environment supportive of this activity.

³ The respondent indicated that he occasionally (Scale 3) works on weekends.

Cross-analyses show that that the respondent's position (SM/O) influences the amount of hours worked per week more than the profession (A/B) they belong to (S.34). Respondents grouped under Senior Management (SM) are more likely to work more hours (S.35).

Overall, Senior Managers are more likely than respondents in Other positions to:

- work more hours (S.35),
- take work home more frequently (S.39); and
- work on weekends (S.42).

Since S.35 and S.42 show dependency at $\alpha=0.05$ (Appendix 11b), the data collected by this study suggests that the amount of work is influenced more by position than by profession and that Senior Management works longer hours than staff in Other positions.

Burke and Cooper (2008) believe that managers and professionals often choose to work long hours as they believe this shows colleagues that they are committed to the organisation and willing to put work ahead of all else. These same authors note that there is evidence of a relationship between amount of hours worked and objective indicators of career success such as income and career advancement.

The above seems to indicate that there is more to working long hours than just productivity. Working long hours can create and transmit a reputation of commitment with the organisation. However, as noted by HREOC (2007) many employers and managers recognise that long hours are not necessarily associated with improved performance or greater productivity, with some even noting that it can have a negative bottom line impact. 'Presenteeism', when employees feel they need to be in the office for long hours to prove their worth and/or deliver outcomes, is identified as one of the main reasons to work overtime (HREOC 2007).

HREOC (2007) suggests that organisations with a high *presenteeism* culture hinder the adoption of flexible working, in part because their employees want to be seen to be working long hours by their co-workers. Table 11.2 is a cross-analysis between the hours worked and the options/attitude towards teleworking.

Table 11.2. [Q13|Q29] Crossanalysis: Teleworking by hours worked per week (h.p.w.)

| Code | Description | Less or equal to 40 h.p.w. | | 41 to 50 h.p.w. | | More than 50+ h.p.w. | | Total |
|-------|------------------------------------|----------------------------|------|-----------------|------|----------------------|------|-------|
| | | Freq. | % | Freq. | % | Freq. | % | |
| 2 | Yes, but I rather go to the office | 12 | 33% | 7 | 27% | 6 | 38% | 25 |
| 3 | No, I would like the option | 7 | 19% | 5 | 19% | 0 | 0% | 12 |
| 4 | No, I rather go to the office | 17 | 47% | 14 | 54% | 10 | 63% | 41 |
| Total | | 36 | 100% | 26 | 100% | 16 | 100% | 78 |

As shown above, the majority of respondents (63%) working more than 50 h.p.w. do not have teleworking as an option at their workplace, but would not like to have the option anyway as they rather go to the office (Code 4). On the other hand, less than half (47%) of respondents working up to 40 h.p.w. selected this option. Possibly a stronger indicator is that 19% of respondents working up to 40 h.p.w who do not have teleworking as an option would like to have the option (Code 3), whereas there are no respondents working more than 50 h.p.w. that would like to have teleworking as an option. This suggests that

respondents with a long work hours culture prefer to go to the office, rather than telework, to show commitment to the organisation.

Based on the Biopsychosocial Model⁴, McMillan and O'Driscoll (2008) made a comparative analysis of explanatory theories on the reasons behind the long work hours culture. An aspect of this model particularly relevant to this research is Behavioural Theory. This theory is based on Skinner (1974) who proposed that if behaviour leads to pleasant consequences it would be repeated, as the person attempts to re-experience the pleasing outcome. Whilst testing this theory, he observed that people tended to imitate the behaviour of role models as an adaptive response that enabled someone to learn faster from successful models rather than experimenting randomly on an individual basis to '*discover*' effective solutions to problems. However, it was observed that this imitation only occurs when the role model is more influential, powerful or with higher social status than the observer/imitator (McMillan and O'Driscoll 2008). In this study that role model is played by Senior Management.

In this regard, the office provides the social space required for behavioural theory to manifest and can create a vicious cycle. Senior Managers' long work hours culture is observed by junior staff, who might identify it as a success factor and imitate the behaviour. The importance of space as a conductor of socially constructed (and praised) behaviour is further discussed in sub-section *b) Emotions*.

Parallel, CS-C participant mentioned that working part-time as well as teleworking could hinder career development (CS-C.3). This issue can be attributed to the above arguments, as well as to Wuorio's (2005) '*out of sight, out of mind*' effect discussed in section 4.2.2*b Context index*.

HREOC (2007) concluded that part time work in Australia carries with it many earnings penalties aside from the expected lower income from working shorter hours. Part-time employment has a negative impact on lifelong earnings and hence on superannuation contributions. Lower earnings are a result not only of the lower number of hours worked but also determined by the type of part-time positions that are available. Permanent part-time work is marginalised through the lack of higher earnings, lower prospects of promotion and missed training and development opportunities. Part time work is often casual employment which lacks the job security and leave entitlements and other benefits of permanent work, and is more likely to be poorly remunerated (lower hourly rates). Casual employment is also often subject to agency involvement, and hence influenced by subtly different loyalty cultures.

Focus groups in HREOC (2007) demonstrated that there is resistance amongst some employers to the idea of part time work for managers. This was also observed in the case of CS-C participant who noted that her employer was initially resistant to the idea of her working part time and her responsibilities as manager changed once she adopted this working mode. Moreover, the participant felt that as a part-timer she needed to work harder than full timers in order to compensate for possible reservation of supervisors (CS-C.4). Given that Teleworking was considered (at her organisation) as a more controversial arrangement than working part-time, teleworking further exacerbates the feeling of working harder. Therefore, CS-C participant concluded that working part-time as well as teleworking

⁴ This model acknowledges the multivariate nature of behaviour and believes that human behaviour is a consequence of the interaction between genes, learning, and social systems. This model is widely used to explain a variety of human behaviours (Copolov *et al.* 2001).

could hinder career development, and thus she could recommend neither for commencing a career (CS-C.3).

The above suggests that the amount of work that people do is subjectively perceived and does not necessarily translate to productivity, but socially constructed considerations.

11.3.3b Working modes, one size fits all?

Result(s) discussed in section: S.57, S.58, S.59, S.60.

Whilst the survey identified that the majority of respondents spend most of their time doing quite-solo-work, followed by face-to-face collaboration and then by building relationships (S.57, S.58, S.59, S.60), a closer inspection of the WSDs in the case studies shows that there are considerable differences between working modes across participants.

WSD report CSB-05a registered up to 90% quite-solo-work, whereas CSB-03a reported as low as 5% in the same working mode, refer to Appendix 9b. Yet, as discussed in section 9.4.4 *Office environment* and shown in the floor plan (Figure 9.2), both employees work on similar workstations in an open plan. This study questions if the same office layout and workstation can equally satisfy such different working modes profiles.

Flexibility is considered to be one of the key attributes of open-plan offices, refer to section 2.7.4. *Office types*. However, this flexibility normally refers to the possibility of changing the office layout at lower cost and with fewer interruptions than enclosed layouts. This study questions if such flexibility can be extended to the ability to properly address the needs of such distinctly different working modes.

Open-plan layouts in combination with modular workstations offer flexibility by standardising space and assuming that employees are interchangeable. A one-size-fits all approach like the one observed in CS-A and CS-B requires that all employees do the same type of work. Data collected from this study suggest this is not always the case. This study therefore believes that an open-plan environment does not offer true flexibility, but demands it from the employees to adapt and compromise.

11.3.4 Organisation context

Result(s) discussed in section: S.79, S.80, S.82, S.83, S.89, S.165.

As discussed in various sections of the literature review, Chapter 2, technology allows people to work from anywhere at any time.

The majority of respondents considered their organisation to be flexible about when employees do their work (S.79). However, most of the respondents considered their organisation to be inflexible about where employees do their work (S.82). Organisations thus, are more flexible about the time work is done than the place where it is done (S.83).

In the literature review Marmot and Eley (2000) identified the need to share technology (when it was bulky and expensive) and to collaborate with workmates as the originating drivers for the development of the office building. Now that technology is more compact, cheaper and more accessible, almost all respondents have the technology required to work from home (S.165). This potentially eliminates access to technology as a main reason for going to the office. It could then be argued that the reason behind the low place inflexibility (as captured by the survey responses) stems from the need to collaborate with workmates in the same place.

However, if collaboration were the reason, it would be expected that both flexibilities be equal so that people can meet at the same place at the same time. Nonetheless, this is not the case and as mentioned above organisations are more flexible about time than about place. If people do not need to work at the same time, it could be argued that they do not need to work at the same place either because time could be considered as another dimension of space in terms of collaboration. Two people in the same place, but at different times, would not be '*closer*' than in different places at the same time. Further, it could be argued that collaborating from different places at the same time is easier than the other way around.

It is therefore possible that the reason behind S.83 (higher time than place flexibility) is the cultural inertia of having to go to an office to work. The reason for low place flexibility could thus be cultural rather than technological or rational.

Various cross-analyses were done in order to identify relationships between time and place flexibility and the professional group (A/B) and company size (1-10/11+). However, the only result that rejected the null hypothesis at $\alpha=0.05$ (Appendix 11b) was S.80 which states that companies with 1-10 employees tend to be more flexible about when employees do their work than companies with 11+ employees. It may be that, as suggested by S.89, smaller organisations are less bureaucratically rigid than larger firms. Although, S.89 accepted the null hypothesis, it has a test of independence value of 0.057.

11.3.5 Technology

11.3.5a Adoption of ICT

Following the ABS criteria, adoption of ICT is measured by a) Computer use, b) Internet use and c) Web presence. Extra parameters were added as part of this study: d) Wireless network, and e) Flat panel monitors. Scanning of documents was also included as a process that denotes a higher ICT maturity.

a) Computer use

Result(s) discussed in section: S.73, S.77, S.78.

All respondents have at least one computer at work (S.73) and almost all depend on a computer to do their work (S.77). It is inconclusive why 3 respondents considered that they do not require a computer to do their work (S.78).

b) Internet use

Result(s) discussed in section: S.108, S.109.

Internet adoption has reached 100% across the whole sample (S.108) with almost all organisations having a broadband connection (cable or wireless). However, there are still few organisations with dial-up connection (S.109).

c) Web presence

Result(s) discussed in section: S.111, S.112, S.113.

Three quarters of the respondents' organisations have a website (S.111).

A direct comparison between the data collected by the survey and ABS censuses on ICT adoption is not possible for two reasons. First, the latest census of adoption of ICT technology reported in ABS (2008) is from 2004-2005, two years older than the data collected by the survey in 2007. Given the increasingly fast rate of adoption, the figures

could have changed considerably in the intervening two years. Second, the business classification does not closely match that of the study. For example, whilst the study indicates a complete adoption of computers and Internet, ABS (2008) reports that in the '*Finance and Insurance*' sector (the closest to the Accountants group in the research study) 95% have a computer and 85% Internet use.

However, an interesting similarity between the two studies is that company size is a contributing factor in the adoption of technology. In both studies bigger companies display higher adoption of ICT than smaller companies. For example, based on the survey, companies with 11+ employees are more likely to have a website than smaller companies (S.113). This result showed dependency at $\alpha=0.05$ (Appendix 11b). The tendency of larger organisations to adopt technology faster is considered in the following sub-sections.

A possible explanation of the above result is that, as mentioned by Rogers (1995), '*Innovators*' need to have substantial financial resources in order to absorb possible losses from an ineffective or unprofitable innovation (see section 2.10.1 *Diffusion of innovation*). This resource condition is more likely to be satisfied by larger organisations.

Parallel, ABS (2008) notes that the use of ICT varies considerably across industries. This could suggest differences between Accountants and Designers. However, despite doing various cross-analyses, the only result that is not within the 10% of error and showed dependency within the parameters of the study is that Designers are more likely than Accountants to have a website (S.112). It is worth mentioning, however, that the ABS study includes industries not related with knowledge workers, for example the group '*Accommodation, cafes and restaurants*' has the lowest overall use of ICT.

d) Wireless network

Result(s) discussed in section: S.74, S.114, S.116, CS-C.13.

Wireless network is a technology still in the process of adoption. The survey indicates that the majority of respondents do not have a wireless network (S.114). The study also suggests that larger companies are more likely to have this technology (S.116). However, it is important to note that the latter is within 10% of the margin error and does not reject the null hypothesis in the independence tests.

Besides being a technology adoption indicator (at this stage), wireless networks have the potential to increase the mobility of employees inside the organisation by allowing them to access information from (almost) anywhere in the office. As identified in CS-C, the lack of network points (and computers) in meeting rooms required prior printing off of information relevant to the meeting. Wireless networks can reduce printing by allowing access to documents anywhere in the office (CS-C.13).

Given that the majority of respondents reported having a desktop computer (S.74), organisations should shift to laptops in order to capitalise on the flexibility allowed by wireless networks. Given the current price differences between hardware types, however, this decision would need to be strategically-driven.

e) Flat panel monitors

Result(s) discussed in section: S.117, S.118, CS-A.8.

As discussed in CS-A, flat panel monitors can reduce the footprint of technology on the workstation (CS-A.8). Based on this advantage, together with the increased display size, flat panel monitor technology has experienced a rather quick adoption. Most of the respondents

have mostly flat panel monitors at their organisation, and a majority has only flat panel monitors (S.117).

The majority of the organisations (6 out of 7) with only CRT monitors are small, with 1-10 employees (S.118).

f) Scanning of hardcopy documents

Result(s) discussed in section: S.124, S.125, S.126.

Possibly motivated towards achieving a paperless office, the majority of respondents scan hardcopy documents (S.124). Organisations with 11+ employees are more likely to scan documents than smaller organisations (S.126). This result, as opposed to the cross-analysis between professions (S.125), satisfies the conditions set by the study to claim statistical dependency.

11.3.5b Technology and organisational context

Result(s) discussed in section: S.137, S.138, S.139, S.140, S.141.

Section 7.4.5i *Adopter type and organisation context cross-analysis* tested a series of hypotheses developed to identify relationship between the organisation context and technology adoption. The data collected from the research confirms the following hypotheses:

- **HO_{time}** = *"Organisations with faster adoption of technology (as measured by question 22) do NOT have higher time flexibility (as measured by question 7)."* (S.137)
- **HO_{Place}** = *"Organisations with faster adoption of technology (as measured by question 22) do NOT have higher Place flexibility (as measured by question 8)."* (S.138)
- **HO_{face-to-face}** = *"Organisations with faster adoption of technology (as measured by question 22) do NOT consider face-to-face interaction less important (as measured by question 9)."* (S.139)
- **HO_{Bureaucracy}** = *"Organisations with faster adoption of technology (as measured by Question 22) do NOT have less bureaucracy (as measured by Question 10)."* (S.140)
- **HO_{Paper}** = *"Organisations with higher type of adoption of technology (as measured by question 22) do NOT have a lower dependency on paper (as measured by question 24 and 25)."* (S.141)

11.3.5c Adopter type perception

Result(s) discussed in section: S.132, S.136, CS-A.28, CS-C.14.

The perceptions of the organisation's adopter type in CS-A varied across participants, almost covering the whole range of Rogers' classification from *'Innovator'* to *'Late Majority'* (CS-A.28). An interesting relationship is that the respondents (CSA-1 and CSA-2) that ranked the organisation's level of adoption highest are both in their 50's, where as the respondents (CSA-3, CSA-4 and CSA-5) that ranked the organisation's level of adoption lowest were younger, in their 20's and 30's.

Given that all participants were assessing the same organisation, it could be said that whilst the perception of technology adoption varies across respondents (i.e. it is subjectively assessed), there could be a relationship between the age (generation) and perceived level of adoption of technology. Based on their relationship and understanding of technology, younger generations might be more critical in assessing the level of adoption of technology of the organisation they work for than older generations.

Similarly, in CS-C the participant considered her organisation to be '*Laggards*' in terms of technology adoption despite the organisation having broadband Internet connection, web presence, only flat panel monitors and a policy to scan hardcopy documents (CS-C.14).

It could then be considered that the subjectivity with which the technology adopter type was assessed could introduce error in the data collect by the survey. Nevertheless, an analysis of the technology index shows that in general, the level of adoption of technology increased with the adopter tendency towards innovation (S.136) and that innovators are more likely than laggards to use more and newer technology (S.132). Therefore, whilst it is considered that the adopter type is subjectively assessed (possibly influenced by age), there was an overall consistency on how it was assessed.

It is worth mentioning that the pre-test questionnaire collected more objective data on technology adoption (e.g. processor, software, etc.), refer to section 4.2.2a *Technology index*. However, such questions were considered '*difficult to respond*' by the most number of pre-test respondents, refer to section 5.3.1 *Feedback*. It was therefore considered that such questions could provide inaccurate data and thus were removed from the final questionnaire used for the survey.

11.3.5d Technology expectations

Result(s) discussed in section: CS-C.42, CS-C.43, CS-C.44

The expectation of improved efficiency created by the introduction of new technology is a source of problems between senior management and staff doing the process when the technology is not properly designed (CS-C.44).

Baccarini *et al.* (2004) note that IT projects are renowned for their high failure rate. Their research suggests that the top five risks of IT projects are (from highest to lowest): personnel shortfalls, unreasonable project schedule and budget, unrealistic expectations, incomplete requirements, and diminished window of opportunity due to late delivery of software. As identified by the authors, these problems were primarily related to project management issues, rather than technical processes. Moreover, they suggest that managing stakeholder expectations is a specific risk treatment that helps to manage several key IT risks.

The above highlights that the main risks in IT projects are not technically based, but a consequence of poor project management. Particularly, a poor management of the expectations of stakeholders.

Technology holds out a panacea in which the future is invariably better than the past (Chaharbaghi and Willis' 2009). That is, *things* (e.g. processes in the case of workplace) will be better because of technology. However, CS-C participant commented that an ongoing problem at her organisation was that people needed to change their processes to suit the technology provided by the IT department, rather than the IT developers giving them solutions that reflect their processes (CS-C.43). Whilst the effects of the problem might be apparent at the '*tool*' stage of Chaharbaghi and Willis' (2009) Technology of Technology process (see Figure 2.4), the problem itself might have been created on earlier stages of the process (e.g. context, purpose or opportunity).

A literature review done by Baccarini *et al.* (2004) identified 27 of the most common risk in IT projects. Amongst these are:

- **Application software not fit for purpose.** There can be a perception amongst users that the software provided does not directly help them with completing day-to-day tasks. This can lead to low user satisfaction (Baronas and Louis 1988).
- **Poor production system performance.** The selected software architecture/platform does not meet the purpose for which it was intended, resulting in a system being released into production which is excessively slow or has major operational problems (Jones 1993; Glass 1998).

Whilst these issues might be perceived as technology based, they could be in fact as mentioned above, a consequence of a lack of IT project management skills.

Parallel, an interesting outcome from CS-C is that the participant's vision of the office of the future is more about making the current office technologies work than implementing new ones (CS-C.42). This result was a consequence of her frustration of not being able to perform simple tasks: *"I would like to be able to send a fax from my computer, without having to print it first, but [the IT department] haven't installed that function, I don't know why"*, see section 10.3.6e *The office of the future*.

Therefore, the distinction should be made between the limitation of technology (as further explained in section b) *Emotions*) and the limitation of IT staff/companies (e.g. developers, consultancies) delivering and implementing technology that satisfies the users' requirements.

11.3.6 Alternative Ways of Working

11.3.6e Teleworking

Result(s) discussed in section: S.77, S.100, S.145, S.146, S.165, S.166, CS-A.27, CS-A.32, CS-B.23, CS-C.14.

Teleworking was offered as an option by less than half the organisations covered by the survey and the majority of respondents working in these organisations prefer to go to the office to work (S.145). Parallel, most of the respondents that work in an organisation where teleworking is not offered, would not like to have the option anyway (S.146). Similarly, all participants in CS-A answered that teleworking is available at their office, but they all prefer to go to the office to work (CS-A.32).

The study therefore identifies a considerable gap between the possible adoption of teleworking (that allowed by technology) and the observed adoption of teleworking (people actually teleworking).

All participants (survey and case studies) have Internet access at their organisations (S.100, CS-A.27, CS-B.23, CS-C.14) and almost all respondents have the minimum technology (computer and Internet connection) to allow them to work from home (S.165 and S.166). Parallel, almost all employees depend on a computer to do their work (S.77), which suggests that information required for work is already in a format suitable to be electronically transmitted and accessed. This was even the case in CS-A, where architectural drawings (traditionally done by hand) are now done electronically with Computer Aided Design (CAD) applications.

The above indicates that, at least technology wise, all organisations and almost all employees in the survey and case studies are able to transfer information (knowledge worker's raw material), and process it from a location outside the office (e.g. home). However, this was not reflected in the level of adoption of teleworking.

This research identifies a) organisational culture, b) emotions and c) myths as three factors that could be hindering the adoption of teleworking. Following is a detailed discussion on each of these.

a) Organisational culture

Result(s) discussed in section: S.94, S.95, S.96, S.97, S.98, CS-C.11, CS-C.27, CS-C.28, CS-C.30, CS-C.32, CS-C.40

Organisational culture was identified in CS-C as the '*biggest problem*' of teleworking. It was noted that there is the perception that if someone is working from home he/she is not working hard, or as hard as he/she could work from the office site (CS-C.27 and CS-C.28).

At the CS-C participant's organisation, teleworking is promoted as a right that needs to be earned and offered only to staff with satisfactory PDAs (CS-C.30 and CS-C.40). Moreover, only employees whose activities are easily monitored and measured are eligible to telework (CS-C.32). These conditions and limitations set for teleworking are not determined or imposed by technology, but are derived from the organisation's culture.

A review of the literature by Martins and Terblanche (2003) suggests that the culture of an organisation may be a contributing factor in the extent to which innovation occurs in an organisation. They define organisational culture as the deeply seated values and beliefs shared by personnel in an organisation which are formed by sets of basic assumptions that worked in the past and are accepted as valid assumptions within the organisation.

This research identifies a paradox based on the above definition of organisational culture and Drucker's (1985) definition of innovation. Since Drucker defines innovations as something new which leads to change and Martins and Terblanche (2003) define organisational culture as being comprised by successful past behaviour, the latter cannot by definition be changed by the former. In other words, an innovation (something new) cannot change something which is defined by successful past experience, in this case the organisational culture. Therefore, an organisation must already be prone to accept innovation in general for an instance of it (e.g. teleworking) to be successfully adopted.

Further, Martins and Terblanche (2003) also note that organisational culture fills the gaps between what is formally announced and what actually takes place. This is particularly relevant because it implies that teleworking will not happen solely by the organisation issuing policies supporting teleworking, but will be delayed until it is reflected by its culture. This phenomenon was captured in the research by the varying success rates of organisations' green policies (S.94, S.95, S.96, S.97 and S.98) and by CS-C participant who noted that for workplace policies to be successful it is necessary, but not sufficient, to provide the technology required to implement them. Policies also need to be promoted and monitored (CS-C.11). Parallel, Arad *et al.* (1997) argue that behaviour that is rewarded reflects the values of an organisation. Thus, until teleworking is treated as a normal alternative, rather than an earned privilege (CS-C.30) it will not be completely adopted by the organisational culture.

As noted by Pitt and Bennett (2008) the culture of an organisation is the most important element for AWW to be successfully implemented.

Nonetheless, an innovation friendly organisational culture does not warrant a successful implementation, as illustrated by Chiat's virtual office in section 2.9.3 *Virtual office*. Other factors of the organisational culture besides its innovation inclination are important. Martins and Terblanche (2003) argue that innovation will flourish only under the right circumstances

in an organisation. In the case of CS-C, trust was identified as an issue which is managed by monitoring and supervision. On this, Judge *et al.* (1997) sustain that management should believe (trust) in employees and encourage them to be more creative by allowing them more freedom, in other words empowering them instead of controlling them. Therefore, if teleworking is to be successful, organisations should focus more on developing trust than controlling techniques for teleworkers.

b) Emotions

Result(s) discussed in section: CS-B.1, CS-B.5, CS-B.10, CS-B.23 CS-B.24, CS-B.25, CS-B.35, CS-B.37, CS-B.38. CS-B.39, CS-B.40, CS-B.41, CS-B.42, CS-C.16

At the time of the interview, Company B, in CS-B, had built a fully operational collaborative environment in Second Life (CS-B.35). This platform could potentially be an ideal interface for teleworking. It has the potential to eliminate geographic boundaries, to offer a better solution to replace face-to-face meetings over other options like video conferencing and to even possibly host the office of the future (CS-B.1, CS-B.5 and CS-B.10). Nevertheless (and despite Company B being nominated by Company A under the understanding that the former was using the latter's technology for work collaboration), Company B was using its Second Life office for marketing purposes only and had not been able to use it for work collaboration activities (CS-B.37).

Meetings were the first work collaboration activity that Company B aimed to implement using their virtual world office (CS-B.38). Smith and Sharma (2002) argue that "*organisations runs on meetings*" and are the preferred way in which people (social creatures) like to work and interact. They believe that meetings can provide a natural systemic way to shape the quality of interpersonal relationships through self-reflection, self-disclosure and emotion, whilst energising individuals to act. Attendees feel a valued part of the organisation, connect internally with their own needs and externally to the need of others (Smith and Sharma 2002). By conducting meetings using Second Life, Company B could potentially transform an integral aspect of work dynamics.

However, the limited capability of virtual worlds to transmit all the information used to establish a connection during face-to-face meetings (e.g. body language) was identified by Company B as the main reason hindering the adoption of virtual worlds (CS-B.39 and CS-B.42). Smith and Sharma (2002) support this view and argue that whilst meetings do not need to be face-to-face, people like it that way and shortcomings are introduced when employees communicate via technology. Lukensmeyer and Parlett (1997) add that "*technology makes it easy to fake authenticity, to manipulate it, to have encounters that seem authentic but are not.*"

CS-B also highlights that communication in virtual worlds is limited by the inability of avatars to communicate emotions (CS-B.41). Whilst attempts to overcome this limitation, refer to *section 2.11.4d World physics*, might eventually allow avatars to show emotions, the literature suggest that emotions play a more complex role in the workplace.

Based on Ashforth and Humphrey (1995), Humphrey *et al.* (2008) note that for decades management scholars recommended that executives practice '*administrative rationality*' by keeping emotions out of the workplace. If emotions were discussed at all, it was mainly in terms of how they interfered with rational decision-making or were part of interpersonal conflict. Parallel, Strongman and Wright (2008) suggest that the traditional Western workplace aims to be based on logic and rationality whilst anything to do with emotion is avoided. They argue that under the traditional but persistent perspective, emotions and

work are antithetical and that the ‘appropriate’ thing to do is to suppress emotion in the workplace.

The following quote in Smith and Sharma (2002), attributed to Lutz (1988), summarises the common attitude towards emotions in the workplace:

“In addition to treating emotion as a physiological state, people regard emotion as a value-laden concept which is often treated as ‘inappropriate’ for organisational life. In particular, emotional reactions are often seen as ‘disruptive’, ‘illogical’, ‘biased’ and ‘weak’. Emotion, then, becomes a deviation from what is seen as intelligent.”

Lutz (1988)

This pursuit for the rational workplace has created the false impression that emotions are, or at the very least should not be, part of the workplace. Nonetheless, Strongman and Wright (2008) sustain that *“in any case, emotions are present in the working environment just as they are in all other human environment.”*

Strongman and Wright (2008) note that there is one particular emotion that is of interest to the workplace. Unlike fear and sadness, which are in-built and biologically based emotions, shame is entirely socially constructed.

“For shame to be experienced the individual needs to have developed sufficiently to have a theory of other minds. That is, she has to be able to appreciate that others have their own perspective, which might be different from hers. Shame involves the individual judging herself to be wanting in some way, in other words to be taking a perspective of herself from an outside point of view.”

Strongman and Wright (2008)

The above authors add that feelings of shame are very unpleasant and the natural reaction is to avoid or control them. Thus, they conclude that shame is a powerful motivator at the workplace because the potential for employees to experience it is ever-present.

Parallel, based on the concept that overwork shows commitment to the organisation in Japan, dozing in a Japanese meeting (called ‘inemuri’) is permitted because it is viewed as exhaustion from working hard and sacrificing sleep at night. Many Japanese employees then fake sleep while in meetings, in order to look committed to their jobs (Burke and Cooper 2008). This reinforces the idea that workplace dynamics are filled with socially constructed rules that need a similar space that can display them and communicate their intention. It is questionable if putting one’s avatar at sleep in a virtual meeting will have the same effect.

This study questions that the complex emotional environment, together with complex socially constructed rules in the workplace can be successfully transmitted via virtual worlds. This limitation could ultimately hinder virtual worlds as an interface for teleworking or as an environment hosting the office in the future.

It is worth noting that Company B has an organisational culture open to innovation (CS-B.23 CS-B.24 and CS-B.25). Thus, it is considered that in this case the gap between what it is technically possible (using Second Life for work collaboration) and what is actually happening (using Second Life for marketing only) is due to a perceived limitation of the technology as opposed to a mere resistance of adoption.

On the other hand, adoption of virtual worlds for work collaboration purposes could be facilitated by the introduction of new generations in the workplace (CS-B.40 and CS-C.16). In this regard, Smith and Sharma (2002) note that face-to-face is no longer the prevailing way of workplace communication, instead technology is fostering what they refer to as '*second hand*' communication and argue that "*virtual encounters have become the norm for those currently joining the workforce who unfortunately lack awareness of anything [being] lost or distorted.*"

As noted in section 2.3 *People*, the experience of growing up online in childhood has the potential of profoundly changing the workplace expectations of Generation F (Facebook). This upcoming generation might expect that the social environment of work reflects the social context of the web, rather than the web reflecting the context of the current workplace. This is important because it could mean that virtual worlds might not need to replicate emotions or communicate complex social rules after all. New generations might be able to accomplish managers' dreams of removing emotions from work environments.

The above is further discussed in section 11.3.12 *Will the office of the future be the future of the office?*

c) Myths

Result(s) discussed in section: S.156, S.157, S.158, S.159, S.160, S.161, S.162, S.163, S.164, CS-C.10, CS-C.37

Overall, non-teleworkers were more likely to select a disadvantage for teleworking than respondents that telework (S.156 and S.157). This could suggest that unproved or false collective beliefs (myths) might be hindering the adoption of teleworking.

Respondents that do not telework are more likely than teleworkers to select the following disadvantages (in order of highest discrepancy):

- **Lack of motivation** (S.162): is the biggest myth with 49% of non-teleworkers considering this to be a disadvantage, compared to only 12% of teleworkers who considered this to be the case.
- **No boundaries between home and work** (S.159): accounts for the highest percentage registered by non-teleworkers (80%), yet only 46% teleworkers consider this to be the case. More non-teleworkers than actual teleworkers are concerned about the possibility of losing such boundaries. On this Pitt and Bennett (2008) believe that IT in general, not only teleworking, can blur boundaries that have traditionally separated work, family and leisure, shifting from Taylor's 9-to-5 model to Bauer's 24/7 routine: working wherever and whenever. Whilst technology is capable of doing that, it is not necessarily what happens (a more positive gap exists between what it is possible and what happens).
- **Lack of suitable environment** (S.164): 46% of non-teleworkers considered this to be a disadvantage, compared with only 19% of teleworkers. However, the office was identified to provide a defined space to work without the distractions of other environments, which also promotes work related interaction by gathering people working towards a common objective (CS-C.10).
- **Isolation** (S.161): accounts for the highest percentage registered by teleworkers (46%), which could suggest that this is a real disadvantage. However, the percentage of non-teleworkers that considered this to be a disadvantage is even higher (62%).

On the other hand, less commuting time was equally selected by teleworkers and non-teleworkers as an advantage of teleworking (S.158). Nevertheless, a higher percentage of teleworkers identified the following as advantages (in order of highest discrepancy):

- **Increased productivity** (S.163): More than half (54%) of teleworkers considered this to be an advantage, compared with only 28% of non-teleworkers.
- **More time with family** (S.160): Teleworkers were more likely (58%) than non-teleworkers (41%) to consider this to be an advantage.

An interesting advantage identified by CS-C participant was that teleworking can help to avoid loss of corporate and historic knowledge by retaining employees that cannot go to the office site to work (CS-C.37).

11.3.6f Hot-desking

Result(s) discussed in section: CS-C.17, CS-C.18, CS-C.19, CS-C.23, CS-C.45

Section 2.9.2 *Hot-desking* highlighted the advantages (mostly financial in terms of asset utilisation) and disadvantages (frustrated employees) of hot-desking.

CS-C described the downsides and possible financial losses when hot-desking is improvised as a consequence of lack of space. Hot-desking that is not properly implemented can be a source of time loss due to the daily routine of employees having to find an available desk as well as setting up and putting away personal items (CS-C.17). Hot desking can also create the feeling of loss of personal space and can be a frustrating experience (CS-C.18). Further, hot-desking was perceived as a '*price-to-pay*' (e.g. for being a part-time worker), rather than a creative solution to space shortage (CS-C.19).

Pitt and Bennett (2008) identified through their review of the literature that loss of personal space and identity were the most common problems create by hot-desking. However, a case study done by the same authors, gives an example of how loss of identity could be overcome by introducing electronic employee profiles. These profiles are accessible from the company's intranet and include (for each employee) a photograph of the employee, description of qualifications, area of work and a link to the *Curriculum Vitae*. As noted by the same authors, electronic employee profiles were proven to be an effective tool which paradoxically allows an employee to retain a degree of status in an office environment that promotes flattened hierarchy.

Whilst, electronic employees profiles do not resolve the loss of personal space, shows how creative solutions as opposed to improvisation (e.g. CS.C) could help to increase the success of hot-desking.

Parallel, CS-C participant is constantly reminded of the cost of rent (CS-C.23) and as a consequence, she considers that in the future offices will have considerably less space as rent becomes more expensive and comfort will be sacrificed at the expense of location (CS-C.45). On this, Pitt and Bennett (2008) warn about the risk of stretching real state. They argue that with staff cost in the region of 70-80% and real estate approximately 20%, a relatively small increase in productivity is greatly more beneficial than a small reduction in real estate costs. This argument highlights that whilst real estate and facilities managers may be aiming to reduce cost, the greatest gains are to be made if consideration is shifted to improving organisational productivity.

11.3.6g Virtual worlds are not green worlds

Result(s) discussed in section: CS-C.20

Philip Rosedale, head of Linden Lab, is quoted by Carr (2006) as follows:

"We're running [Second Life] at full power all the time⁵, so we consume an enormous amount of electrical power in collocation facilities. We're running out of power for the square feet of rack space that we've got machines in. We can't for example use [Blade] servers⁶ right now because they would simply require more electricity than you could get for the floor space they occupy."

Intrigued by the above, Carr (2006) did a series of calculations to estimate the electrical consumption of one avatar and concluded that an avatar consumed 1,752 kWh per year (as at 2006). He then compared this figure with the average human consumption per person of 2,436 kWh per year. Carr (2006) concludes that an avatar consumes less energy than the personal average annual energy consumption worldwide.

A detailed comparison shows that when compared with developed countries avatars appear *"considerably less energy hungry than humans"* since the per-capita energy consumption in these countries is 7,702 kWh per year (Carr 2006). On the other hand, in developing countries the per-capita consumption is much less, averaging only 1,015 kWh, thus an avatar uses more electricity than the average person in a developing country. Carr estimates that the energy consumption of one avatar (1,752 kWh) is similar to that of one Brazilian (1,884 kWh).

As noted by Carr (2006) *"avatars aren't quite as intangible as they seem. They don't have bodies, but they do leave footprints."* The yearly energy consumption of one avatar (1,752 kWh) represents approximately 1 tonne⁷ of carbon dioxide per year. As mentioned in section 10.3.6b *Home Based Working*, CS-C participant produced 5.64 tonnes of carbon dioxide per year commuting to work (based on CS-C.20).

Whilst it could be said that CS-C participant could reduce her carbon emission by more than a fifth by using Second Life as an interface to telework, this might not be the case once other factors are considered. Below is a discussion on why virtual worlds and teleworking in general, might not be as green as expected.

11.3.6h Teleworking not as green as expected

Result(s) discussed in section: S.154, S.158, S.160, S.170, S.167, CS-C.20, CS-C.33.

In section 2.9.1 *Teleworking*, Nilles defined teleworking as *"any form of substitution of information technologies for work related travel."* This implies that employees working in this mode use technology at home (for example, but not necessarily, virtual worlds) to connect remotely to the office site.

⁵ See 'Persistent' concept in section 2.11.4 *Virtual worlds*.

⁶ Blade servers are stripped down computer servers with a modular design optimised to minimize the use of physical space (Wikipedia 2009d).

⁷ Calculated using 'Greenhouse Gas Conversion Factors' developed by Carbon Trust (www.carbontrust.co.uk) based on 'Grid electricity' factor of 0.537 KgCO₂ per unit: 1,752 kWh x 0.537 kgCO₂ = 940.824 kgCO₂, approximately 1 Tonne of CO₂.

The survey indicates that the above concept is well understood by participants since “*less commuting time*” was not only the most common advantage of teleworking selected across all respondents (S.154), but the most common response across teleworkers and non-teleworkers (S.158). Parallel, CS-C participant noted that: “*working from home offers the advantages of doing more things rather than just sitting in the car*” and she perceived teleworking as a way to reduce the amount of travel which in her case represented 5hrs per day and produced ½ a tonne of CO₂ per month every day (CS-C.20). According to the survey the majority of respondents use cars as the main way of transportation to get to work (S.170).

Further, pilot projects like the one undertaken by the City of Calgary in 2007 reported that 656 fewer commuting trips were recorded within four months of part-time teleworking. This was estimated to avoid 80,000 kilometres of driving, saving 7,000 litres of fuel and approximately 18 tonnes of CO₂ (Calgary Economic Development 2009).

Parallel, Flood and Barbato (2005) highlight the negative effects of long hours of commuting on family and community life, noting that in Australia each week over 10% of working parents spend more time commuting than they do with their children, travelling for between 10 and 15 hours weekly to and from work but spending less time than this supervising, caring for and transporting their children. This phenomenon was also captured by the survey where the majority of respondents that telework considered ‘*more time with family*’ to be an advantage of telework (S.160).

Nevertheless, the majority of respondents spend 1 hr or less in daily commuting to work, return (S.167) and teleworking might not necessarily reduce the emissions of CO₂ proportionally. It was observed in this research that CS-C participant incorporates other trips into her commuting routine. For example, leaving her daughter at the child care-care which is near her office (the one closer to their home did not satisfy them). If she teleworks she would still have to drive her daughter to child-care and do other commutes (e.g. shopping) that were previously integrated in her daily work commute. This finding is also supported by SUSTEL (2004): “[Some] Teleworkers had to make special trips for activities previously carried out as part of commuting” refer to Table 2.9, Chapter 2. This suggests that it could be erroneous to believe that teleworking will proportionally reduce the amount of daily travel.

Parallel, it could also be argued that the actual CO₂ saved by transport (after the above observation is taken into consideration), could be further diminished once the emissions generated by individually illuminating and heating/cooling the homes of teleworkers are taken into account. Further, the emissions saved on transport by teleworkers could potentially reverse as Green Star certified office building become more popular.

The Green Star certification is developed by the Green Building Council Australia (GBCA), a national, not-for-profit organisation established in 2002. The certification is a voluntary environmental rating system that evaluates the environmental design and construction of buildings. Whilst GBCA has developed tools for certifying convention centres, schools and shopping centres these are still pilot efforts and the vast majority of their 176 certified projects to date are office buildings. GBCA has certified 11% per cent of Australia's CBD commercial office buildings (GBCA 2009).

Green Star covers 9 categories (Management, Indoor Environment Quality, Energy, Transport, Water, Materials, Land Use & Ecology, Emissions and Innovation) that assess the environmental impact that is a direct consequence of the project site selection, design, construction and maintenance (GBCA 2009). Therefore, it could be more sustainable (less

CO₂ emissions) if people commute to a Green Star certified office building, than having them teleworking in a (possibly) less efficient homes.

In this regard it is important to note that since the Green Star certification is given to the building and not to the organisation occupying it, the certification process does not take into consideration if the organisation offers teleworking. It is therefore considered that the certification would benefit from an approach similar to that of OH&S discussed in CS-C. As per CS-C.33 the Operational Health and Safety Act considers the home site an extension of the office site and as such the area assigned as office inside the teleworker's home needs to comply with the same OH&S regulations as the office site. A similar approach in the Green Star certification would ensure that teleworkers are working in an environment as efficient as the office site.

Still, it is considered that even if the home environment is equally efficient, cooling/heating several discrete environments (office site plus several home sites), will produce more emissions than cooling/heating just one certified office site.

11.3.7 People revisited

Prensky (2001) notes that a *“really big ‘discontinuity’ has taken place”* between generations and allures to the concept of singularity point as previously defined to highlight the situation. However, Prensky's most novel contribution is an interesting analogy between IT culture and the culture of a country. He coined the terms *‘Digital Natives’* and *‘Digital Immigrants’*.

- **Digital native:** Are *‘native speakers’* of the digital language of computers, video games and the Internet. IT is an integral part of the lives of Digital natives. They like to receive information really fast, to parallel processes and multi-task.
- **Digital Immigrants:** Need to learn to adapt to the IT environment. They can learn the *‘new language’* but always retain to some degree their *‘accent’* (their foot in the past).

Digital immigrants think learning cannot (or should not) be fun because they did not spend their formative years learning with *Sesame Street* (Prensky 2001). Similarly, Digital immigrants see a computer as a working tool, because they first used it for work, whereas digital natives learned how to use a computer by simply playing with it. Thus, current managers do not think the workplace should be fun, because for them it traditionally has not been.

“Smart adult immigrants accept that they do not know about their new world and take advantage of their kids to help them learn and integrate. Not-so-smart (or not-so-flexible) immigrants spend most of their time grousing about how good things were in the ‘old country’.”

(Prensky 2001)

Given that technology and space (architecture) are created to serve people's needs, the current workplace reflects the needs of Digital immigrants (the decision takers as previously defined in section 11.3.1b Age). Digital natives, however, have different needs and ways of doing things that will inevitably affect the space required to undertake their future work activities (whatever they be, see section 11.3.11 *The future of work*).

11.3.8 Space revisited

Result(s) discussed in section: CS-C.5.

Section 2.4 *Space (and Cyberspace)* elaborated on the characteristics of physical space and introduced the concept of cyberspace (e.g. virtual worlds), whilst section 2.11.4 *Virtual worlds* offered a more detailed description of virtual environments. Both sections suggest that virtual worlds could be equivalent (to an extent) to the real world and thus “*ease and decongest physical world situations, or create new solutions to common architectural problems*”.

Case Study B, however, identified that the inability to communicate body language and ones emotions (as well as read those of other people) was the main reason hindering the adoption of Second Life for work collaboration purposes. As documented in section 2.11.4d *World physics*, efforts are being made to remediate this shortcoming. Possibly, in the future body language and emotions could be seamlessly transmitted through virtual worlds. Alternatively, emotions might not need to be transmitted due to a shift in the way people interact in the workplace (see section d) *emotions*, under section 11.3.6g *Teleworking*).

Nonetheless, it was through this limitation that an important characteristic of space for workplace architecture was identified. Space is not only a “*three dimensional extent in which objects and events occur and have relative position and directions*” as described in section 2.4 *Space (and Cyberspace)*. Space is a channel for communicating and reading other people’s emotions. Under this context, Cicognani’s analogy between a building and a software interface as described in section 2.4 *Space (and Cyberspace)* seems inadequate. Buildings do not just contain and organise space as software interfaces organise electronic space to host content. Popper’s ‘World 3’ and Lefebvre’s social space as previously discussed are a defining characteristic of workplace environments.

It is then possible that, as observed from CS-B, our understanding of the properties of the ‘*real*’ space can be furthered by identifying the limitations of ‘*virtual*’ space.

An interesting result is CS-C.5: “*Being at the office promotes casual work related interaction with workmates. Since this interaction arises randomly and out of impulse it might not be as effective, or necessary, as if it was carefully planned and addressed during a formal meeting.*” This result was generated whilst the participant was questioned on the importance of casual interaction at her job fostered by being at the same space (office) and how that would be impacted by teleworking, see section 10.3.3 *Work habits*. The result is interesting because she believes that bumping into people ‘*triggers the need to meet*’ and generates unnecessary conversation. Thus, she believes she could possibly be more productive if she worked from home and avoided unnecessary (as in time consuming, less productive) social interactions.

However, as discussed in section 11.3.3 *Work habits*, socially constructed behaviour at work is not just about productivity and in her case, space could be a contributing factor in a very important attribute of her role as a manager: leadership.

Maccoby (2004) suggests that the reason people follow their leaders is because of transference. The concept of transference was probably Freud’s most important contribution and refers to the idea that people can idealise others independently of the own personal attributes of the latter. When people idealise others not based on their own personal attributes is usually because they relate to them as an important person of their past, usually a parent.

“Suppose an employee believes that her boss will care about her in a parental way. To ensure that this happens, she will make superhuman efforts to please her leader.”

Maccoby (2004)

Transference is the emotional glue that binds people to a leader (Maccoby 2004) and as previously discussed ‘real’ space is a better conductor of emotions than virtual space. Thus, non-virtual offices could be a factor contributing to leadership and producing better managers.

11.3.9 Technology revisited

Section 2.5.2 *Singularity point* argues that technology is evolving at a rate that could irreversibly transform human life, including (obviously) workplace architecture. Further, section 2.11 *Developing technologies* documents technologies that each have the potential to create an irreversible change in workplace architecture. Therefore, it would be reasonable to believe that workplace architecture could be irreversibly transformed even before 2045, the date set by Kurzweil (2005). But will singularity eventuate just because it is technologically possible?

The identified gap between the possible adoption of teleworking (that allowed by technology) and the observed adoption of teleworking (people actually teleworking) as discussed in section 11.3.6e *Teleworking* raises the questions: is technology actually driving change in the workplace, or is it just enabling change? Is technology a driver or enabler of change?

The last part of section 2.2 *People, space and technology*, briefly introduced the idea of technology as an enabler, rather than as commonly believed, a driver of change in work environments. Steiner (2005) notes that *“technology has often been cited as the key driver in work-style changes, but interestingly, this has not necessarily been the reality. In actuality, is the power of the human factor that is the key force.”* He adds that technology can only influence the workplace if:

- The costs of implementing the technology are not prohibitive; and
- The workforce successfully adopts and utilises the tools to their full potential.

This research supports the idea that technology is an enabler and not a driver of change in workplace architecture. Common definitions of the word ‘drive’ refer to it as ‘to make things happen’ whereas definitions of the word ‘enable’ refer to it as ‘to make things possible’ (Cambridge dictionary 2009; Merriam-Webster 2009). Results of the survey and case studies are consistent in that they suggest that technology is making it ‘possible’ (enabler) for people to work from home (e.g. telework), to share working space (e.g. hot-desking), or even to work in a virtual world (e.g. Second Life). However, technology is not actually making any of these happen (driver).

The identified drivers to adopt AWW in CS-B and CS-C were mostly financial, for example, to reduce travel or real estate costs. This was also identified by SUSTEL (2004), noting that whilst teleworking can offer environmental benefits (e.g. reduce carbon emission), *“in practice it is economics rather than environment which is the main driver.”*

This research supports the idea that economics is the driver, technology is the enabler, and organisational culture a condition for innovation to happen.

11.3.10 People, Space and Technology revisited

Result(s) discussed in section: CS-B.37, CS-C.43

As briefly introduced in section 1.3 *Research problem* and further discussed in section 2.2 *People, Space and Technology*, several authors (Becker and Steele 1994; Mawson 1994; Johnson and Scholes 1989; Robertson 2000; Fernando 2003; Steiner 2005; Sayers 2006) identify the relationship between people, space and technology. A common characteristic between these models is that a change in one area (e.g. technology) will have an effect on the other two areas (e.g. people, space) and is the basis of this research.

Whilst this research agrees and supports the above authors' theories, a limitation was identified in their diagrams, see Figures 1.1, 2.1, 2.2, and 2.3 in Chapters 1 and 2 respectively. It is considered that these diagrams fail to capture the dynamic nature of the process. Figure 11.1 is based on the above-mentioned figures but incorporates a time factor.

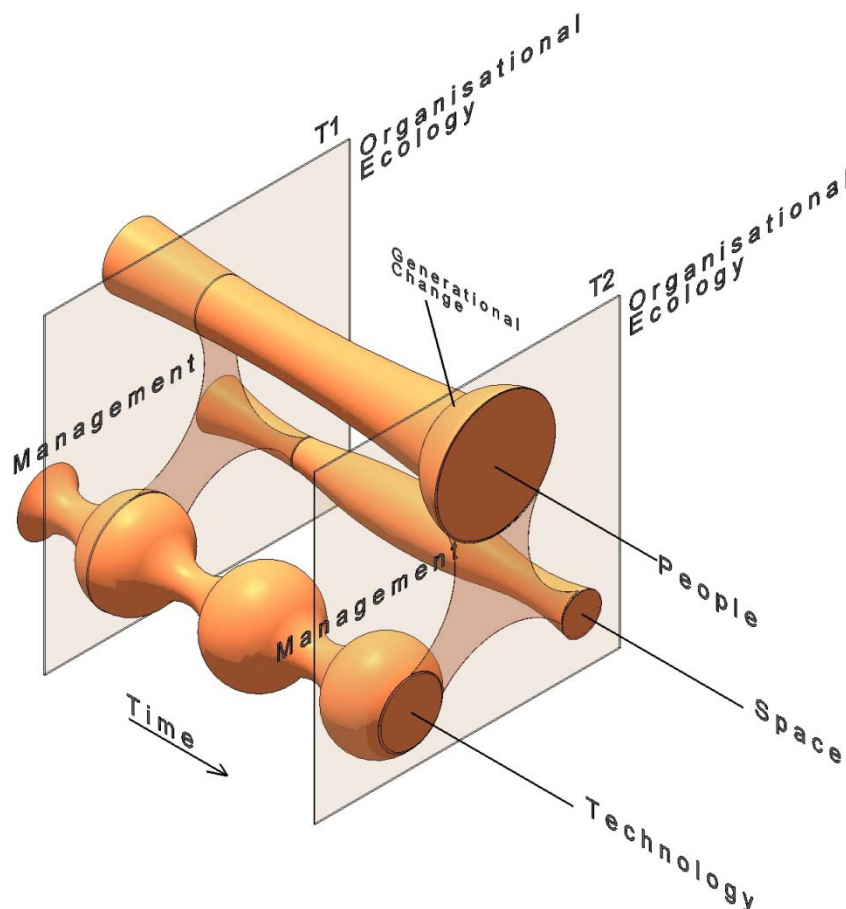


Figure 11.1. People, Space and Technology: dynamic view

As in the earlier diagrams, People, Space and Technology are also represented by three circles in Figure 11.1. In this case, however, when a change is experienced the radius of the circle changes (e.g. big changes are represented with a big radius) and since the third axis (depth) is time, a longitudinal extrusion, reflecting the history of change is created.

The above diagram broadly reflects the results and observations of this research. "Technology" changes more often and faster than "People" and "Space", hence the frequent

expansion and contraction of the extrusion. On the other hand, the ‘fixed’ nature of “Space”, make it less dynamic and creates a more cylindrical-like extrusion because changes take place over a longer period of time and are (usually) not big changes. Finally, “People” is considered to have a slower change rate, in part created (or imposed by) the organisational culture as previously discussed. Nonetheless, it is anticipated that the up-coming generation (Gen Y or Facebook Generation) can potentially create big changes (CS-B.37; Sayers 2006), and thus the sudden increase in radius of the People’s circle in the above figure.

T1 and T2, as shown in the above figure are two cross-sections at two different points in time representing changes in the organisation’s ecology. These two sections are detailed in Figure 11.2, where T1 shows a cross-section at a time in which technology is experiencing a change, whereas T2 denotes a change in people. The area holding together the three elements is identified as the management.

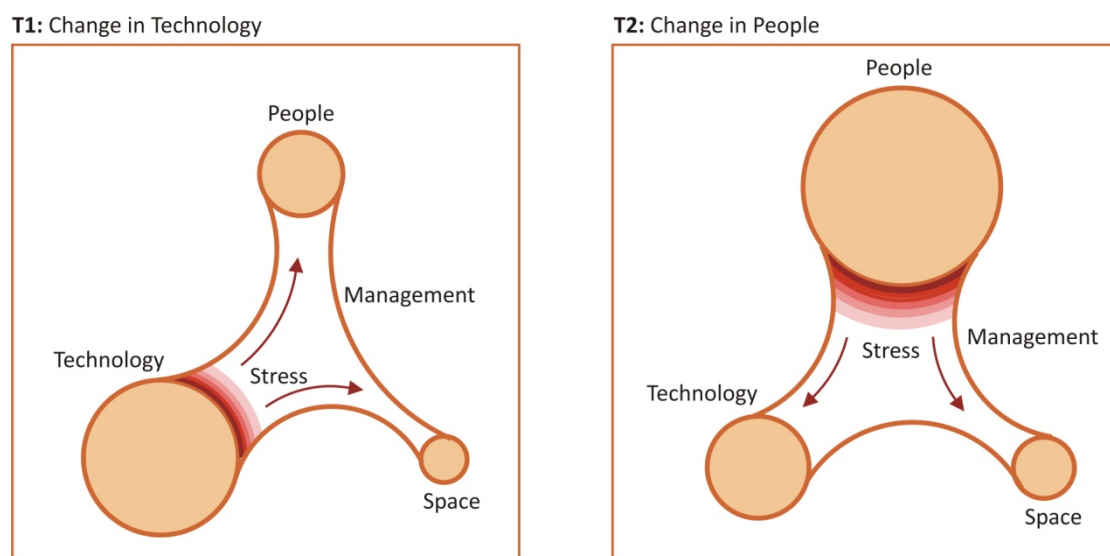


Figure 11.2. The organisational ecology – Sections at T1 and T2.

Figure 11.2 suggests that when change is experienced, stress is exerted on the management and transmitted to the remaining two areas. This was observed in CS-C. When a change in technology occurred at the case study participant’s organisation, it created stress by demanding changes in the way staff do their work (CS-C.43).

Given the parallels between the above abstract model and how a physical material would behave if put to similar conditions, physical terms (e.g. stress, strain, etc.) are considered as suitable analogies to describe the model, in particular the behaviour of management. Indeed, the analogies could be taken a step further and actually model management using physical properties.

Whilst the final theoretical understanding of a physical-state based model of organisational ecology is beyond the scope of this research, the basic concepts are elaborated here to justify its appropriateness and highlight its potential. The suggestion to further develop this model is discussed in section 12.4 *Further research recommendations*. The following section is a brief discussion of the parameters that could be modelled based on the proposed People, Space and Technology diagram (Figure 11.1).

11.3.10i Modelling of management

"To model a phenomenon is to construct a formal theory that describes and explains it."

Hodges (2009)

Management geometry

As mentioned above, the cross-sectional area linking People, Space and Technology in Figure 11.1 and Figure 11.2 is identified as management. As seen in these figures (more clearly on Figure 11.2) the geometry (shape) of management changes from T1 to T2. The management geometry of T1 would not 'fit in' T2, and vice versa. This suggests that *a)* the management style required to manage a change in technology (T1) might be different from the one required to manage a change in people (T2) and *b)* the management style could be related to its geometry.

Therefore, a taxonomy of 'management geometries' could be useful to first identify particular managerial styles based on particular configurations between people, space and technology and then, to suggest suitable management styles for similar situations in the future. Figure 11.3 classifies the different management geometries created by different scenarios.

| Change in: | Technology (T) | People (P) | Space (S) |
|-----------------------|------------------------|------------------------|------------------------|
| Driven by: | IT Department | HR Department | Architect/FM |
| Management Geometries | | | |
| Management Styles | T(P>S) to T(P<S) | P(T>S) to P(T<S) | S(T>P) to S(T<P) |

Figure 11.3. Management geometries taxonomy for dynamic states in organisational ecology.

The first column of the above figure exemplifies a change in Technology (T) and shows two opposing geometries based on the status of the other remaining areas (People and Space). In the case of ' $P>S$ ', top model, People (P) is going through a bigger change than Space (S) but not to the extent that is bigger than Technology. The model below, ' $P<S$ ', shows the opposite scenario. The bottom row lists the two possible management styles (or ranges of

styles) for a change in Technology: $T(P>S)$ and $T(P<S)$. Further research could help define the specific requirements or change agenda of each case. The next columns describe the process for People and Space.

Management material

In order to properly model management, the material selected needs to behave as the assumptions done about management by the model. Therefore, selecting the right material for modelling is crucial for the success of the model. Figure 11.3 suggests that management needs to be elastic enough in order to acquire the various shapes required to successfully connect (e.g. manage) all possible scenarios.

In physics, elasticity involves changing the size or shape of an object, or both. The internal forces that resist deformation are due to short-range forces between atoms. In a rigid object (e.g. non-deformable) the separations between all pairs of particles remain constant when subjected to external forces. This type of material would not be suitable (analogously) for the management model. Further, all real bodies are deformable to some extent (Serway 1996). On the other hand, a perfectly flexible material (e.g. an ideal shock absorber) would absorb all the stress without transferring it to the other two areas, which as observed in this research and documented in the literature, is not the case in management.

Since the expertise of selecting the material is outside the domains of the researcher, the latter wishes to acknowledge the assistance of fellow PhD candidate Ehsan Gharaie in this very technical process. As described below, the similarities between the behaviour of the material and the proposed managerial assumptions exceeded initial expectations for the analogy.

A viscoelastic material was chosen over '*simpler*' materials (e.g. Newtonian materials), because it has the capacity to exhibit viscous and elastic characteristics that better mirror management.

According to Lakes (2009) viscoelastic materials behave as follows:

- a. if the stress is held constant, the strain increases with time (creep);
- b. if the strain is held constant, the stress decreases with time (relaxation);
- c. the effective stiffness depends on the rate of application of the load; and
- d. if cyclic loading is applied, hysteresis (a phase lag) occurs.

Following is a brief discussion on how the above properties can be used analogously to model the behaviour of management.

Point 'a)' Creep

The stress is the force that wants to change a system. In this model, the force can be an external force that wants to make a change in one part of the organisation. As a result of this stress, strain happens. Strain in this case is the change and it can be seen in terms of a change in the shape of management (see *Management geometry* above).

In an organisation, when a stress is implemented in one part the strain (change) will go on as long as the stress (force for change) lasts. For example, if a force on an organisation to implement a change in IT (e.g. implement CAD) starts and continues, the change would start in the first susceptible part but would not stop there since there is a continuous force for the change and thus it would expand to the other parts of organisation.

Figure 11.4 shows two charts. The chart on the top plots the stress (σ) as the cause and the chart below plots the strain (ε) as the effect against time (t).

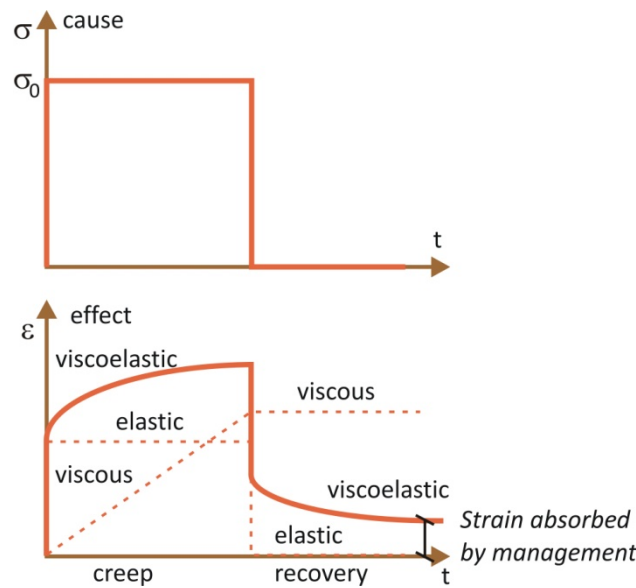


Figure 11.4. Creep and recovery: stress and strain vs. time (Lakes 2009).

There are two important characteristics from the above figure that can be related to the management model.

- From the above it can be seen that the strain caused by the stress increases with time as the stress is held constant. This is analogous to an organisation as the effects of a change in one area (e.g. Technology) would not immediately be transmitted across the whole organisation. There would be a delay, but eventually it would impact the whole organisation.
- As seen in the bottom chart, strain is absorbed by the viscoelastic material (management) as it does not go back to its original strain value previous to the stress. In the modelling of management, this means that management buffers the strain (change) created by the stress (force of change) in an organisation.

Point 'b)' Relaxation

The relaxation phenomenon is demonstrated when a change happens and is kept constant in the system. In this case the stress result of that change would decrease with the passage of time. This behaviour can be seen in an organisation. For example, moving into a new office (Space) will create stress in the organisation (and be transmitted to other areas – People and Technology).

A move to a new office is a change that happens once and the physical state would be constant after that, until the next change. This change (moving to new office) creates stress in the organisation initially, but as time goes by the stress of the change starts to decrease and the system returns to its stable condition.

Dependency of stiffness to the rate of load application

The stiffness of a viscoelastic material depends on the rate of load application. Higher rates of application result in higher stiffness and lower rates result in lower stiffness. Knowing

about creep, it could be concluded that for an effective change in an organisation, the force of change should be at a low rate to minimise stiffness of resistance and the low rate must be constantly implemented to effect a big change in the whole organisation.

Hysteresis

A hysteretic system is a system with a memory. In viscoelastic materials if a cyclic force happens, the result of the second cycle is not only the reaction of this cycle but it is a reaction of the first cycle and the second one. This phenomenon derives from the fact that the reaction of a viscoelastic material to a stress is time dependent. Therefore, if a stress happens on it in the first cycle, even after the release of the stress, the system is still reacting to that stress. If during this reaction another stress happens (second cycle), the reaction will be a combination of the first and second stress.

This phenomenon can be seen in an organisation when there is a frequent change of managers or when management directions are issued too frequently. For example, when a manager issues a direction (stress) its effects (strain) start to be transmitted across the organisation. However, if during this expansion of strain to other parts of organisation, the manager issues another direction, the result of the second stress will be the result of the first direction plus the first one. It means the organisation behaves hysteretically.

Introducing Rogers' Diffusion of innovation to the model

Viscoelastic materials are usually represented using a purely viscous damper and a purely elastic spring connected in series, known as Maxwell model (Lakes 2009). See Figure 11.5.

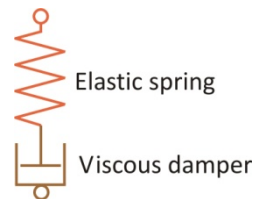


Figure 11.5. Maxwell model (Lakes 2009).

The above is particularly relevant to this research because it allows us to introduce Rogers' diffusion of innovation technology (see section 2.10.1 *Diffusion of innovation*) into the model.

Figure 11.6 shows the oscillation frequency of the spring component of Maxwell's model in orange (light colour) at the top. This frequency could be related to the frequency of technology development (e.g. each cycle of an innovation). The two curves (dark brown colour) below represent two frequencies of two dampers with different viscosity. This frequency could be related to Rogers' adopter type.

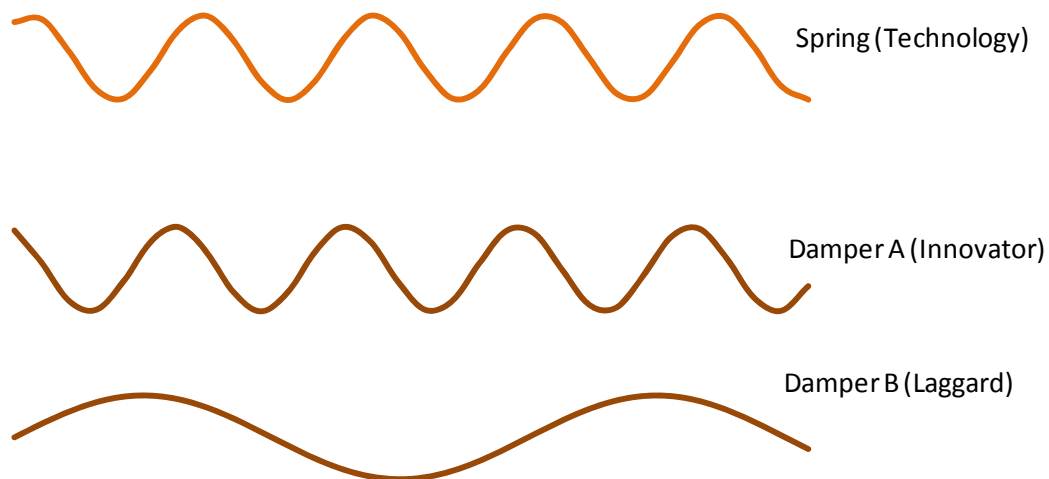


Figure 11.6. Modelling adoption of innovation using analogous spring and damper oscillation frequencies and Rogers (1995).

As seen from the above, *Damper A* has a frequency similar to the spring and would be capable of following the spring movement. This type of damper could be related to an *Innovator* technology adopter, as it mimics the frequency of technology. On the other hand, *Damper B* has a longer frequency and as such is unable to move at the same rate as the spring. This damper could be associated with a *Laggard* technology adopter.

Further development of this analogous model is not undertaken here, since essentially this task lies beyond the scope of the present research. The conceptual presentation, and discussion of the theoretical underpinnings and potential application, however, are considered to be important contributions from the research.

11.3.11 The future of work

The concept of a jobless society as a consequence of technology development was introduced in section 2.8.1 *The myths of the office of the future*. This section reviews the concept of work in order to discuss in more depth the possibility of technology unemployment. The discussion here developed is fundamental to understand the future of the office and is the cornerstone of the following and last section 11.3.12 *Will the office of the future be the future of the office?*

11.3.11a The importance of work

“Work is far more important to people than just the money they make.”

James *et al.* (1997)

From the earliest beginnings, civilization has been structured around the concept of work. From the Palaeolithic hunter/gatherer to the assembly line worker of the 20th century (and to the knowledge worker of this century), work has been an integral part of our daily existence. Work is the basis of society and is the way large numbers of people are

productively organised. It is both a noun and a verb. Eliminating work would require a rethinking of the very basis of the social contract (Rifkin 1996).

According to James *et al.* (1997) the concept of work is not static and has changed through time and cultures. During the Greco-Roman antiquity Aristotle considered that work and education stood in opposition to one another, while both were also in opposition with leisure. In the Judaeo-Christian tradition, God himself is a worker who rests on the seventh day and His work is creative and good; whereas the work of humans is futile, transitory, and a punitive and necessary legacy of sin. Whilst they are few, developments of the concept of work during Modern Philosophy (taken to begin with Descartes) are crucial. Before this, work was mainly understood as an element in the determination of the essence of the human being, but in Modern Philosophy both humanness and work are brought together in a re-definition of work. This is mainly because activeness establishes reality, and it is thus considered that reality is obtained through the human act of working. Then life itself becomes a function of work. Kant in his lecture on Ethics commented: *"the more we are busy, the more we feel we are alive, and the more conscious we are of our life. In leisure we don't feel only that life is just passing us by, we also feel even lifelessness"* (James *et al.* 1997).

James *et al.* (1997) highlight the different concept of work between Australian Aborigines and 18th Century European explorers. They argue that Australian aborigines had no concept of work that would allow them to assimilate Western civilisation. Nonetheless, whether or not Aboriginal peoples had a European concept of work, they must have worked in order to survive (James *et al.* 1997). In addition, Marmot and Eley (200) note in section 2.7.1 *History* (of the office) that the concept of today's office would have puzzled a 15th Century craftsman, still the craftsman worked.

Jones (1981) argues that work is economically, socially, psychologically and perhaps even physiologically necessary. Whilst the greatest single fear of withdrawal from work might be economic, work is essentially a physiological element. According to Jones (1981), people work:

- a) To provide economic support for themselves and their families;
- b) to reinforce a sense of identity;
- c) to combat boredom; and
- d) to feel needed in a societal context outside the family: for approval, applause and reward.

According to Jones (1981) our self-esteem and the opinion that others hold of us is confirmed and defined to a large extent by what we do, rather than what we are. Jones argues that our need to work is analogous to the need to have a home, which he defines as an essential element of self-definition. Thus, like the homeless, unemployed people may have a disabling loss of identity.

11.3.11b Defining work

As this section shows, defining 'work' is far more complex than establishing its importance. Peitchinis (1983) highlights that it is not the nature of the activity that determines whether it is work or not, but rather whether a direct payment is made for the performance of the activity. For example, running, writing and painting, if not paid, are perceived as hobbies (amateurs). On the other hand, the same activities with a direct payment are perceived as work (professionals).

The nature of payment is also what differentiates an employee from a volunteer. Whilst the activities done by both could be the same and done with the same intensity, what differentiates them is the fact that one is paid and the other one is not (Peitchinis 1983). Although it is common now to refer to “*volunteer workers*” and “*voluntary work*”.

Nonetheless, the same author argues that defining *work* based on a direct payment is limiting its definition to the perspective of an economist. Work, more generally, could be defined as any activity which is not specifically classified as relaxation. This distinction opens the possibility to have paid work and un-paid work (e.g. housework, care work, church work and club work, amongst others). The problem resides now in defining relaxation.

Relaxation does not infer idleness, but to do an activity with a different purpose from work (Peitchinis 1983). In this regard, Owen (1969) argues that relaxation is defined not by the objective purpose that the activity serves or the intensity with which it is done, but rather the subjective intent with which the activity is approached.

If work is defined by what is not relaxation and relaxation is defined by the subjectivity of how the activity is approached, then ‘*work*’ is a subjectively defined concept.

On the other hand, Peitchinis (1983) argues that employment is easier to define because employment by definition is limited to paid activities (the economist’s point of view discussed above). In other words, work is determined by the ability and willingness to pay for whatever activities people can perform. This definition is further discussed in section 11.3.11d *Unlimited employment*.

11.3.11c Technology unemployment vs. technology employment

As seen from Aristotle’s quote below, the idea of technology unemployment was not triggered by the Industrial Revolution of the 18th Century.

“If every instrument could accomplish its own work, obeying or anticipating the will of others, if the shuttle could weave, and the pick touch the lyre, without a hand to guide them, chief workmen would not need servants, nor masters slaves.”

Aristotle

More recently, authors from distinct disciplines and epochs support the idea that technology will not only take physical work from labourers at the factory, but also from knowledge workers at the office.

“The role of humans as the most important factor of production is bound to diminish in the same way that the role of horses in agricultural production was diminished and then eliminated by the introduction of tractors.”

Leontief (1983) Nobel laureate

“While earlier industrial technologies replaced the physical power of human labour, substituting machines for body and brawn, the new computer-based technologies promise a replacement of human mind itself.”

Rifkin (1996)

On the other hand, technology might actually produce the opposite effect and make people work more. McMillan and O'Driscoll (2008) argue that the introduction of the light bulb in 1880 enabled employers to over-ride nature's rhythms of night and day which, in conjunction with electrically run machines, enabled factories to run 24 hours a day. For the next 60 years the general workforce was denied weekends and paid holidays. More recently, in Section 6.5.2 *Work Sampling Diary*, the concept of 'Day extending' was introduced to refer to knowledge workers at Intel extending their workdays into early-morning and late-night hours to allow for real-time collaboration across different time zones with their geographically dispersed teammates.

Peitchinis (1983) notes that predictions that technology will cause massive unemployment are based upon two related premises:

- a) Technology makes it possible to produce more of the goods and services that are being produced with less and less human labour; and
- b) demand for those goods and services will fall short of the technical capacity of the economy to produce them.

Whilst both premises are valid, Peitchinis makes the key distinction that they are only valid in relation to the goods and services that were being produced by technology that is being displaced, notwithstanding whether those goods and services are exactly the same or in modified forms. However, the premises are not valid in relation to new goods and services produced by the new technology; nor valid either in relation to new processes of production and distribution induced by the new technology; and not valid in relation to goods and services generally. In other words, they are valid in relation to the replacement of a typewriter with a word processor, but they are not valid in relation to office and office-related services generally (Peitchinis 1983).

Therefore, Peitchinis (1983) argues that there is no dispute over the reality that goods and services are being produced in larger and larger amounts by less and less labour. The dispute is about whether this reality will cause general unemployment. He argues that historical records indicate that technology has tended to not only increase the capacity to produce more, but has also increased incomes and facilitated the production of different goods and services. As seen from the quotation below technology has the potential to create new jobs:

"Job titles more common in sci-fi novels such as space tour guide and molecular engineer will soon become common place... Competitive innovation will produce hot jobs that are hard to imagine now."

Zappala (2009).

'Web designer' and 'Security Systems Engineer' were unheard and unknown job titles not so long ago, yet both were in the list of "10 Hot jobs for 2007" (Tuggle 2007).

On the other hand, businesses that, according to Williams (2007), are likely to disappear in the near future include record stores, photographic emulsion film manufacturing and newspapers (in the paper form). All of these declines are because of the arrival of a substitute technology: MP3, digital cameras and internet and e-paper. However, following Peitchinis (1983), there will still be people involved in the businesses of music, photography and information.

11.3.11d Unlimited employment

Despite technology (e.g. robots) taking over manufacturing jobs there will still be unlimited employment in the future. Based on our human nature, our desires and ambitions are limited only by our imagination and thus the amount (and type) of work to be done is, similarly, limited only by imagination. The future of work is therefore assured, because our personal ambitions to enjoy the goods and services that the world affords are essentially without limit, the work required to provide those goods and services is likewise, unlimited (James *et al.* 1997).

Parallel, Peitchinis (1983) believes that unlimited employment could be warranted in the future, but requires a shift in our economic models. Peitchinis' critical point is the relationship between what people do and the ability to pay. If ability to pay is independent of the activities in which most of the people engage, that is, if economic growth and the resultant ability to pay is the result of non-human factors of production, then full employment can be maintained by the simple act of payment for activities which do not contribute to output, but which contribute to social welfare. Technology is expected to produce the surplus which will facilitate the ability to pay for activities that are related to the general well-being of the population at large (Peitchinis 1983).

Based on Margaret Mead, Peitchinis (1983) notes that we *"need to get rid of the dichotomy between work and leisure. Between what you are paid to do, the way in which you get hold of a bit of the currency of a country, and your involvement in the country. Between the right to experience the benefits, at a certain level of food, medical care, and education, and the possibility of using one's gifts to the limits."*

As seen above, James *et al.* (1997) and Peitchinis (1983) offer two different ideas on why and how technology unemployment can be avoided. Whilst the former depends on human traits (unlimited ambitions), the latter requires a shift of the economic model with technology actually creating the required surplus to 'liberate' us from work. This research combines both ideas together with the human dependency to work as identified by Jones (1981) to suggest that independently of technology development, work will continue to be an integral part of human life.

Whilst we might not be able to recognise the concept of work in the future, people most probably will still be working. If the concept of work evolves beyond recognition, would we (hypothetically) be able to recognise workplace environments? What would the space (if any) hosting tomorrow's work would be like? The final section of this chapter explores the possible future of the office.

11.3.12 Will the office of the future be the future of the office?

"The ability to do nearly everything with anyone from anywhere in any virtual-reality environment will make obsolete the centralised technologies of office buildings and cities."

Kurzweil (2005)

The concept of the office of the future was introduced in section 2.8 *The office of the future*, and allures to a highly efficient environment driven by technology (Immel 1985) which as noted by Marmot and Eley (2000) in section 2.10 *The future of the office* and by various authors in section 2.11.4 *Virtual worlds*, the office (or what it evolves to) might not even need a physical space. By integrating these concepts, it could be said that the expectations

of the '*office of the future*' are for a highly efficient, technology driven, decentralised environment (possibly) hosted in a virtual world.

Based on the above definition, this research believes that the *office of the future* will not be the future of the office. Whilst it is considered that the *office of the future* scenario might be a transitional stage of the office in the future, if only because those are the common expectations, it might only be a transitional phase. Moreover, this version of the office might not be adopted by all innovators, because its adoption will not necessarily depend on a technology basis alone, but on the social interactions required to function effectively.

This research favours the retention of a centralised physical place, but with a decentralisation of information, that supports and reflects human traits as the workplace of the future (whether it is still called an office or not).

Possibly, the office in the future would be alien to us in its activities (what is considered work) and in the space hosting it (architecture), but it might not be alien to us in the sense that it could be more reflective of the human nature that imbues and inhabits it.

11.4 SUMMARY

This chapter has integrated the results generated by the analysis of the survey and case study data. Based on the methods developed and described in Chapter 6, results were compared, further analysed (including testing for significance) and discussed in terms of the relevant sections of analysis introduced in Chapter 7.

The concepts of People, Space and Technology were individually revisited and contributions derived from the results were made. Likewise, the People-Space-Technology model was expanded dynamically and by introducing the concept of time. In representing the balance between these elements the role of management was identified and added. Analogous concepts from physics were used to briefly frame the model development and to suggest directions for future research.

Finally, a review of the concept of work was done to better understand the possible future of the office and the office of the future.

The next chapter presents the final conclusions of the research.

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER

12

12.1 INTRODUCTION

This chapter re-addresses the research questions and draws conclusions from the most important findings. Limitations of the research based on a critical reflection are discussed and the contribution of the research under an epistemological context is presented. The intellectual merit and broader impact of the research are identified. Areas of further research are proposed.

12.2 ADDRESSING THE RESEARCH QUESTIONS

As described in section 3.2.1 *Research questions*, this study has two broad (*grand-tour*) questions which are further divided into two sub-questions. Below are the answers obtained by this research.

12.2.1 To what extent is information technology changing workplace architecture?

The research deliberately limited investigation of this question to office environments, largely on the grounds that this is the most common workplace encountered, and exists (at least in part) in almost every workplace that uses buildings as a location. Design offices and accountancy offices were chosen as representative of the most likely extremes of office environments.

The existing and developing information technologies reviewed in the literature (e.g. hologram teleconferencing and wireless electricity) as well as those studied in this research (e.g. teleworking, hot-desking and virtual worlds) have the potential to considerably change the type (nature and quality) and amount (quantity) of space required to work.

However, the extent and rate at which information technology could change workplace architecture are limited mainly by organisational culture and myths and to a lesser degree by actual limitations of technology (e.g. the inability of virtual worlds to transmit emotions).

12.2.1a SQ-V-1 Will there be a change in the type of office space required in the future?

Overall, current office environments satisfy the environmental and spatial parameters measured by the study. However, the poor level of voice privacy offered by open-plan office design is a serious concern for occupants.

The research found that purposely designed environments were not significantly better than adapted spaces in satisfying environment parameters.

The generalised adoption of computers across professions and positions has standardised knowledge workers' requirements, and to a considerable extent has narrowed the differences between designers and accountants in the configurations of their workplaces. This is an indication in itself that information technology has changed space requirements. Modular (typical) workstations coupled with open plan layouts, have also created a

standardisation of the office plan. As a consequence, the capability of distinguishing profession by reading the floor plan has considerably diminished. Similarly, floor plans do not necessarily denote hierarchical status of occupants.

Nevertheless, the biggest problem of workspace standardisation could be that a one-size-fits all approach requires (assumes) that all employees do (broadly) the same type of work. Since this is not always the case, modular workstations on open-plan layouts offset the flexibility they purport to offer by demanding it instead from employees, requiring them to adapt and compromise. For example, even within a single discipline office, such as a design company, some designers may require substantially large side desk space adjacent to their work stations in order to accommodate a large amount of hard copy reference material; while other designers in the same office may not. To standardise the office configuration based upon the latter workers' needs would impact negatively upon worker productivity. On the other hand, providing a larger desk area as standard might lead to spatial inefficiencies.

Given these shortcomings, the longevity of the combination of modular workstations with open-plan office layouts is questioned.

The research also found that, whilst virtual worlds (e.g. Second Life) are successful in replicating a three dimensional world (geometry) and offering tools to facilitate work collaboration, they cannot presently effectively communicate body language and human emotions. Since emotions, together with non-verbal communication, are an important element in the workplace, virtual worlds are (currently) limited in their capacity to effectively host work environments. Nonetheless, younger generations may adapt more easily to this limitation and make the adoption of virtual worlds for work collaboration possible.

It was through this limitation, however, that an important characteristic of space for workplace architecture was identified. Space is a facilitating channel for communicating and reading people's emotions.

Parallel, the office building (space) was considered part of the identity of the organisation. It contributes to the image and status the company wishes to convey.

Given its shortcomings in pleasing environmental parameters and properly satisfying the various working modes, the combination of modular workstations and open-plan floor layouts is likely in future to include a more specifically designed work environment, probably with more enclosed spaces that better support various working modes. The office building (space) will still continue to contribute to and reflect the identity of the organisation occupying it.

12.2.1b SQ-V-2 Will there be a change in the amount of office space required in the future?

A high adoption of alternative ways of working (AWW) - teleworking, hot-desking or virtual worlds - for work collaboration would considerably reduce the amount of office space required as work would be performed somewhere outside an office (e.g. home, café). Therefore, a change in the amount of office space required in the future will be largely influenced by the level of adoption of AWW.

Whilst most respondents and participants in the research were able to adopt teleworking from a technology perspective, factors like organisational culture and myths were identified as limitations for its rapid adoption in reality.

Hot-desking was perceived as an obvious solution to shortage of space, but is also a source of less obvious inefficiencies (e.g. time lost) which could, over the long run, prove counter-productive. Moreover, whilst hot-desking purports to maximise asset utilisation, it ignores employees' needs for personal space and workplace identity.

Overall, the cultural inertia of '*having to*' go to work to an office, has the potential to override any technological or rational solution that would otherwise challenge such a proposition. Parallel, highly energy efficient buildings have the potential to provide a 'greener' solution than teleworking, since economies of scale have the capacity to deliver greater environmental benefits than a commensurate replication of numerous small "home office" locations.

It is therefore considered that the amount of office space required will not be reduced considerably by technology developments. Instead, economic drivers (increased rent costs) in premium (CBD) locations are likely to increase the density of people working in a given space.

12.2.2 How is IT changing workplace architecture?

Information technology changes workplace architecture because it changes the way (process) people work.

However, the role of IT as a *driver* of change in workplace architecture is questioned, and that of an *enabler* favoured. This research supports the idea that economics is the driver, technology is the enabler, and organisational culture a condition for innovation to happen in the workplace.

Based on the identified paradox between organisational culture and innovation, an organisation must already be prone to accept innovation in general for it (e.g. teleworking) to be successfully adopted.

12.2.2a SQ-P-1 Why is IT changing space requirements in the office environment?

Despite not always being the case, technology offers the hope that because of it the future will be better than the past. For organisations this means that, amongst other benefits, information technology promises better (more efficient) processes, less travel or less physical space requirements.

Information technologies with the potential to reduce (directly or indirectly) the amount of space required are attractive to organisations. In fact, the technologies studied in this research aim to reduce space (and costs) by having people sharing desks (hot-desking) or not requiring a desk in the office (teleworking and virtual worlds).

However, it is not only technologies focussing on space strategies that can change space requirements. The outcome of the technology of technology approach (see Figure 2.4) is a new '*Technique*'. The new technique might need a very different space to support its function. For example, by replacing hand drawing with CAD, designers developed a new technique in the production of drawings which in turn required a new type of space configuration.

12.2.2b SQ-P-2 How will the office of the future be like?

Based on the common expectations set for the '*office of the future*' (a highly efficient, technology driven, decentralised environment possibly hosted in a virtual world), the

findings of this research support the argument that *the office of the future will not be the future of the office*.

The office of the future scenario might only be a transitional stage. Moreover, this version of the office might not be accepted by all Innovators because its adoption will not necessarily depend on a technology basis alone, but on the social interactions required to function effectively. These interactions are likely to be inter-generationally influenced.

Based on the observed attributes of space and its role in work dynamics, the retention of a centralised physical place is advocated, possibly allied to a decentralisation of information processing and storage that supports and reflects human traits. This is likely to be the workplace of the future, whether it is still called an office or not.

It is even possible that the office of the future will be alien to us in its activities (what is considered work) as well as in the space hosting it (architecture), but it might not be alien to us in the sense that it could be more reflective of the human nature that imbues and inhabits it.

The quest to address the questions posed by this research has led from exploration of the requirements of workplace architecture to consideration of technology change and even to reflection of the nature of work itself. It is evident that designers, building owners and building managers must follow a similar path of enquiry if the workplace needs of tomorrow's society are to be satisfied effectively and efficiently.

12.3 LIMITATIONS OF THE RESEARCH: A CRITICAL REFLECTION

Whilst the overall research limitations are discussed in section 1.5 *Research scope*, 3.3 *Research approach*, and 3.3.5a *Type of survey*, discussion is offered here on limitations identified post-data collection and general reflections on the research process.

While several months elapsed between the data collection of the survey and the case studies, the implementation is considered concurrent because the data collection of the case studies was not dependant on the results of the survey, refer to section 6.4 *Mixed methods*. However, the research could have benefited from a sequential implementation in reverse order. That is, doing the case studies first, including the analysis and interpretation of findings, and then using the results as a basis for developing the survey questionnaire. This sequential approach would have had allowed the incorporation of some of the findings of the case studies in the survey, such as investigation of the importance of social space in the workplace.

Other aspects that could have improved the research include:

- **Better sampling catalogue:** As noted in section 6.3.1 *Sampling catalogue*, finding a suitable catalogue from which the companies could be randomly sampled was the most challenging task of the pre-data collection stage. Outdated company details in the selected catalogue (Yellow Pages) translated into a considerable amount of Return To Sender (RTS) survey packs, refer to section 7.2 *Administration of the research instrument*.
- **Improved WSD (Work Study Diary) data collection:** Even though the WSD included a section for respondents to specify how representative the study week was (and most respondents considered it to be fairly representative), the study would have benefitted from a longer (perhaps two week) individual study. It is worth noting,

however, that increasing the data collection timeframe could have reduced the response rate.

In the case of CS-C the WSD was applied close to the Christmas break and although the participant considered the study week to be a '*fairly representative week*', there are some activities that were specific to such time of the year, refer to section 10.2.1 *Data quality*.

- **Face-to-face interviews with (selected) CS-A participants:** Face-to-face interviews proved useful in CS-B and CS-C. Interviews with CSA-1 and CSA-5 would have proven beneficial to better understand capability/willingness to work from outside the office.

Despite the limitations noted above, it is considered that the research successfully addresses the research questions and satisfies its objectives set in section 1.4 *Research objectives*.

12.4 RESEARCH CONTRIBUTION AND RECOMMENDATIONS

The purpose of research is to increase our understanding of the phenomenon with which we are concerned or interested (Leedy 1997). By better understanding *why* and *how* technology developments change workplace architecture, this research helps architects, facility managers and business managers in the design, maintenance and management of office environments challenged by technology development.

A contribution of this research is highlighting the paramount role of people in determining (through their adoption) the impact and extent that technology development has in workplace architecture.

Architects, facilities managers and business managers are encouraged to engage in strategic planning and managerial styles compatible with the increasingly flexible working environments arising from emerging paradigms fostered by new technologies. However, the main recommendation of the research is that the workplace should be designed, maintained and managerial styles developed for people to benefit from technology. Inverting the priority by procuring spaces and management styles based on what technology can do whilst overlooking people's needs is likely to produce unsuccessful work environments.

The research proposes a novel approach to better understand the dynamic nature of the interaction between People, Space and Technology. Whilst the development of this model is yet to be undertaken, it is considered an important contribution of the research.

12.4.1 A note on contributing to the body of knowledge

"Contribution to the body of knowledge" is considered a common objective and expectation of PhD theses. This research however, favours the term *"theoretical propositions with instrumental value"* over *"knowledge"* as its contribution. Following, is a review of some epistemological issues put together to illustrate the difficulties of claiming knowledge.

It is worth mentioning that this limitation does not stem from shortcomings of the research, or a poor research design, but from a series of philosophical problems encountered by epistemologists trying to define knowledge. Further, the purpose of the following discussion is not to contribute to the discussion of the philosophical nature of knowledge (which is beyond the scope of the research), but to note the limitations of claiming knowledge under an epistemological context.

12.4.1a A (brief) discussion on knowledge

“All knowledge is human; that it is mixed with our errors, our prejudices, our dreams, and our hopes.”

Popper (1963)

The following discussion is limited to the type of knowledge pursued by research: propositional knowledge with instrumental value, but it is not the only type of knowledge that exists. As opposed to ability knowledge (know-how), propositional knowledge is what is asserted by a sentence which says that something is the case. For example: *“adapted office spaces are better than purpose designed ones”*. Such proposition, if true, has instrumental value because it would help architects to make decisions on their space requirements. However, as discussed below a theoretical proposition with instrumental value, even if true, does not necessarily qualify as knowledge (Pritchard 2006).

The first problem in claiming knowledge is to actually define what knowledge is. As noted by Pritchard (2006) it is *‘tempting’* to define knowledge by pointing out the cases in which it is believed to be manifested and then considering what is common to each case. The problem with this approach is that if one does not already know what knowledge is, then how can one correctly identify cases of knowledge? This is known as the problem of the Criterion, which states that:

- a) One can only identify instances of knowledge provided one already knows what the criteria for knowledge are; and
- b) one can only know what the criteria for knowledge are provided one is already able to identify instances of knowledge (Pritchard 2006).

Methodism and Particularism are two contemporary opposing stances that try to provide a solution to the problem of the Criterion. Whilst the former states that it is only through philosophical reflection that knowledge can be defined, the latter sustains that particular instances of knowledge can be identified and collectively establish the criteria for knowledge. Given that Particularism requires identifying instances of knowledge (instead of assuming that knowledge exists) this stance is widely supported by scepticism (Pritchard 2006).

The one thing that almost all epistemologists agree on is that the minimal condition for knowledge is a True Belief (TB). However, this condition is far from being sufficient and epistemologists have the challenge of defining what else needs to be added to a TB for it to be considered knowledge (Pritchard 2006).

In order for a TB to get closer to knowledge it should be justified. Justification is a way of ensuring that there are good reasons to believe in what one does. Based on *Agrippa’s Trilemma* there are three ways in which TBs are justified:

- 1. Our beliefs are unsupported;
- 2. our beliefs are supported by an infinite chain of justification; or
- 3. our beliefs are supported by a circular chain of justification (Pritchard 2006).

As with the problem of Criterion, conflicting schools of thought have emerged in an attempt to solve this trilemma. Fundamentalism (Option 1) argues that some beliefs can be justified without the need of any further beliefs because they are self justified. These beliefs are immune to doubt and self-evidently true. However, they are extremely rare and the

difficulty of linking all other beliefs to “*I think, therefore I am*” (this belief is self justified, because by doubting it is proven to be true) is the main criticism to this stance (Pritchard 2006).

Infinetism (Option 2) holds that an infinite chain of justification can justify a belief. This approach is considered unsustainable because there is no final justification at the end of the chain supporting all other arguments. Moreover, some critics argue that finite minds cannot produce infinite chains of justification, which renders the whole process invalid (Pritchard 2006).

Finally, Coheritism (Option 3) argues that a circular chain of supporting grounds can justify a belief. A requirement of this approach is that the circular justification needs to be ‘*sufficiently large*’ for it to support the belief. However, no matter how large the chain is, at the end, the supporting argument is the original belief (Pritchard 2006). It could even be argued that coheritism can be summed up into infinitism if the circular reference is pushed so much further down the claim that it tends to the infinite.

Therefore, whilst the purpose of the 11 preceding chapters of this thesis is to justify the conclusions offered above, under an epistemology context the research remains unjustified until it could be linked to “*I think, therefore I am*”.

Furthermore, Hume argues that knowledge based on induction, like this research, is unjustified. Hume’s logical problem with induction can be summed up in that it is not rationally justified in reasoning from repeated instances of what we have had experience to instances of which we have no experience. That is, the regularities that are observed within a representative sample do not increase the likelihood that the unrestricted generalisation is true. As noted by Born (1949): “*no observation or experiment, however extended, can give more than a finite number of repetitions, therefore the statement of a law (B depends on A) always transcends experience.*” Thus, whilst the induction premise (observation) can be true, the conclusion (generalisation) can be simultaneously false. As opposed to deduction, in induction the knowledge of a premise does not follow the knowledge of the conclusion (Pritchard 2006, Vickers 2008). It is worth stressing that this generalisation problem is independent of the sample size or its representativeness, but a result of an embedded flaw in induction.

Even if (somehow) a true belief is justified (JTB), it still cannot be labelled as knowledge. Gettier (1963) suggests that it is possible to have a JTB and yet lack knowledge because it is due to luck that the belief in question is true. Moreover, it would be of no credit to the researcher. Gettier’s original case is too long for this discussion. The ‘*stopped clock*’ case, however, as developed by Pritchard (2006) is a shorter example of a Gettier case. In this scenario a person forms her belief about what the time is by looking at a stopped clock that she has every reason to believe is working. However, she happens to look at the clock at the one time in the day when it is showing the right time, and so forms a true belief (TB) as a result. Her belief is both true and justified (JTB), and yet it is not a case of knowledge since it is just luck that her belief is true given that the clock is not working.

In another Gettier-like case, developed by Chisholm (1989), a person forms a belief that there is a sheep in the field by looking at a shaggy dog which happens to look just like a sheep. However, there is in fact a sheep standing behind the dog, and hence her belief is true. Her belief is justified because she has great evidence for thinking that there is a sheep in the field (she does see what looks to be a sheep). Whilst she has a JTB, she cannot claim knowledge.

From these two examples, it is epistemologically not possible to eliminate the possibility that a researcher could arrive at JTB by claiming 'x' (sheep), when measuring or observing 'y' (dog), but by chance 'x' was also present at exactly the time the clock was showing the right time. These conditions would allow the researcher to '*get it right*', yet just '*getting it right*' is not knowledge. Knowledge cannot be gained by formulating beliefs that become true just by chance. Forming one's belief in such way will eventually produce false beliefs (e.g. gambling).

Section 3.3.1 *Epistemology* defined constructionism as the epistemological position of the research. As a consequence, this research does not (cannot) unveil an objective truth. Therefore, the minimum condition set by epistemologist for knowledge, a TB, cannot be satisfied. Instead, studies with this type of epistemology offer a humanly fashioned way of seeing things. As mentioned by Crotty (1998) "*at best, our outcomes will be suggestive rather than conclusive. They will be plausible and helpful ways of seeing things, but certainly not any 'one way' of seeing things.*"

It is beyond the scope of this research to contribute to the above discussion. A Philosophic degree however, cannot overlook these epistemological complexities involved whilst claiming knowledge. Therefore, as mentioned above, the term "*theoretical propositions with instrumental value*" is preferred over "*knowledge*" as the contribution of this research.

12.5 INTELLECTUAL MERIT AND BROADER IMPACTS OF THE RESEARCH

This section has been added based on comments from one of the examiners who suggested the use of the evaluation criteria adopted by the National Science Foundation (NSF) in the USA to assess the intellectual merit and broader impacts of research projects. Comments below therefore include reflections made since the submission of the original thesis for external examination in late October 2009.

12.5.1 Intellectual merit

12.5.1a Contribution of the research to knowledge advancement and understanding within the research field and across different fields.

The research and its findings provide a useful framework for designers, facilities managers and business managers to better inform their decision making for workplace design.

People, not technology, are identified as setting the rate of change in workplace architecture. The research supports the idea that economics is the driver, technology is the enabler, and organisational culture (people) a condition for innovation to happen in the workplace.

Workplace should be designed and maintained, and managerial styles developed, so as to enable people to benefit from technology. Inverting the priority by procuring spaces and management styles based on what technology can do whilst overlooking people's needs is unlikely to lead to successful work environments.

12.5.1b Creative, original, or potentially transformative concepts flowing from the research.

The research design itself is considered to be original in this field and could provide a creative framework for further exploration. It may be a useful guide for other researchers to

follow. The mixed methods approach, comprising survey and case study techniques, yielded rich data capable of rigorous analysis and interpretation and leading to appropriate conclusions and recommendations.

Although based on existing models, the PST tool developed in this research offers a novel approach to better understand the balance between People, Space and Technology. The dynamic capabilities of the PST tool are conceptually innovative and are already being exploited at a practical and professional level by the researcher.

12.5.2 Broader impacts

12.5.2a The contribution of the research to advancing discovery and understanding whilst teaching, training and learning

The thesis content and findings will facilitate a better understanding of workplace design for students and design practitioners.

Interest has been expressed to using the thesis as an important point of reference for a research initiative within an academic institution in USA. The researcher is also exploring opportunities to develop workplace design curricula at a similar institution in Australia.

As noted in section 1.7.2 *Conferences as presenter*, a total of four papers have been presented at peer-reviewed international conferences to date. Given the stage at which they were produced, the papers are either conceptual or describe methods used in the research.

A conference paper entitled “*Will the office of the future be the future of the office?*” (Paper ID 729) discussing the main finding of the research will be presented at the upcoming CIB World Congress in mid May 2010 in the UK (Congress stream W11-Usability).

Future journal and conference publications are planned. Possible book transformation is under consideration by the researcher and supervisors team, as suggested by one of the external examiners to the thesis.

12.5.2b Benefits to society

The research opens up a potentially valuable area for further research; at the same time providing a useful ‘*theory of practice*’ resource for designers and facilities managers.

The researcher is now employed as a research consultant by a leading international workplace and retail design firm in Melbourne, Australia. As a consequence, results of the research have been discussed with peers and presented to clients at various workshops. Aspects of the research were included in a recent (March 2010) strategic planning for a client (software developer) in Singapore.

12.6 RECOMMENDATIONS FOR FURTHER RESEARCH

The immediate research recommendation derived from this research is the further development of the dynamic People, Space and Technology model (Figure 11.1), particularly in relating the element connections to specific management styles and strategies.

In fact, the PST tool is currently under further development by the researcher as part of his engagement with the design organisation as mentioned above. The first stage of development is to make it a diagnostic tool. The second stage will lead to a predictive (forecasting) tool.

Further research should also investigate information technologies that have the potential to change the way people work (refer to section 2.11 *Developing technologies* for a list of proposed technologies). Part of the future research should study failed attempts at such technology implementation. This would allow better understanding of the adoption process as well as the true nature of the process that the new technology is trying to replace.

Research is also recommended into the evolution of space requirements as a consequence of technology development in the remaining two strategic sectors of society (health and education), refer to section 1.2 *Background*.

Further research could investigate the social qualities of space as a channel for communicating and reading people's emotions and other human traits (e.g. knowledge transfer) and how this would produce better working environments.

More exploration needed by designers into: workplace drivers; alternative ways of working; adoption of IT development; workplace communication channels; social space emotional environments; and organisational cultures and myths.

It is considered that whilst architecture (design) should remain the focus of future research in this area, a multi-disciplinary approach including disciplines such as business management, sociology, psychology, philosophy, information technology, environmental science and physics could yield better results.

12.7 RECOMMENDATIONS FOR CURRENT PRACTICE

Acknowledgement of the significant social and human component of space whilst designing and maintaining work environments is recommended to architects and facility managers. The applicability of the PST model characteristics as a design guide is encouraged.

Designers should give more attention to voice privacy needs as well as to better understand and take into consideration the different space requirements of people based on their working habits.

12.8 SUMMARY

This chapter has considered the extent to which the research questions have been answered. The limitations of the research have been noted, and the contribution of the research in an epistemological context has been discussed. The intellectual merit and broader impact of the research have been identified. Recommendations for further research have been made, and changes to current practice proposed.

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Appendix 4a

Test Survey Kit:

Cover letter

Test questionnaire

Questionnaire assessment form

TEST-COVER LETTER

*PRINTED ON RMIT University (School of Property, Construction and Project Management)
Letterhead paper*

<Date>

<Title> <Name> <Surname>
<Company Name>
<Company Address Line 1>
<Company Address Line 2>

Dear <Title> <Name>,

Your collaboration is requested to pre-test and assess a questionnaire that will be the principal instrument to collect data that will be used to research on the evolution of workplace architecture as a consequence of technology development.

Computers, together with e-mail and Internet, have revolutionised our way of working. Technology is changing the space required to undertake work related activities. The focus of this research is to understand *how* and *why* technology is changing workplace architecture.

You have been selected as your input and comments are deemed valuable for the research. Your candid response on the questionnaire as well as on the assessment form is encouraged.

Enclosed you will find:

- **Questionnaire:** This is a copy of the proposed research instrument. Please time yourself as you fill in the questionnaire as an approximated completion time will be asked for on the assessment form
- **Assessment Form:** After you have completed the questionnaire, please provide your comments using this form.
- **Return envelope:** Please insert the questionnaire, together with the assessment form in this envelope.

All information provided is strictly confidential. The success of this research depends on your participation.

Thank you for your help.

If you have any questions please contact the undersigned or:

Dr. Guillermo Aranda-Mena
Research Supervisor - RMIT University
e-mail: guillermo.aranda-mena@rmit.edu.au

Yours faithfully,

(Signed)

Agustin Chevez

PhD Student - RMIT University
e-mail: s3032925@student.rmit.edu.au

encl.: Questionnaire, Assessment Form and return envelope.

TEST-QUESTIONNAIRE PAGE 1/5

QUESTIONNAIRE

Please tick the box ☒ next to your preferred answer.
When finish please insert the questionnaire in the provided envelope and mail it at your soonest convenience.

Thank you for your co-operation!

ID:

All information that you provide on this survey is strictly confidential.

The Identification number on the questionnaire is for monitoring and analysis purposes only. Your name and company will never be associated with the answers you give.

| 1 | Evaluate the following parameters at your workplace: |
|--|---|
| A) Temperature comfort | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| B) Ventilation comfort | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| C) Illumination comfort | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| D) Background noise level | Noisy 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Quiet |
| E) Frequency of distractions | Frequent 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Rare |
| F) Visual privacy at your workstation | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| G) Voice privacy at your workstation | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| H) General office distribution | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| I) General furniture arrangement | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| J) General office size | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| K) General office storage space | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| L) Individual storage space | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| M) Work space available on workstation | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |
| N) Overall satisfaction of the space environment at your workplace | Poor 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Good |

| 2 | From the following list rank the deficiencies that apply to your workplace. |
|--|---|
| Shortage of space (in general) _____ | 2 a <input type="checkbox"/> |
| Insufficient storage space _____ | 2 b <input type="checkbox"/> |
| Inadequate privacy _____ | 2 c <input type="checkbox"/> |
| Inappropriate layout of workstations _____ | 2 d <input type="checkbox"/> |
| Other: <input type="text"/> | 2 e <input type="checkbox"/> |

Rank '1' the most critical shortcoming.
Leave blank the ones that are not a problem.

| 3 | In what type of building is your office located? |
|----------------------------|---|
| 1 <input type="checkbox"/> | Adapted home / apartment unit |
| 2 <input type="checkbox"/> | Adapted warehouse or other non-office building |
| 3 <input type="checkbox"/> | Office building or building designed for the organisation's activities. |

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4 Which layout best describes your workplace?

1 ☐ **Enclosed:** Consists of individual rooms (full height walls) with a corridor for access.

2 ☐ **Open-plan:** No internal walls or fixed partitions. Space is divided into movable working stations.

5 On average, people at your workplace are:

1 ☐ Most of the time at their desk

2 ☐ In and out their desk

3 ☐ Rarely at their desk

6 How many meeting rooms are at your workplace?

1 ☐ 0 2 ☐ 1 3 ☐ 2 4 ☐ 3 5 ☐ 4 6 ☐ 5 7 ☐ 6 8 ☐ 7 9 ☐ 8+

7 How would you describe the number of meeting rooms?

1 ☐ Insufficient

2 ☐ Sufficient

3 ☐ More than required

8 Has any space been adapted to allow for more storage space?

1 ☐ Yes. Which one(s): *Tick all applicable* 7 ☐ No

☐ 2 Office

☐ 3 Meeting room

☐ 4 Toilet

☐ 5 Kitchen

☐ 6 Other:

9 How flexible is your workplace about when employees do their work?


Employees must work within a specific time frame. 1 ☐ 2 ☐ 3 ☐ 4 ☐ Employees can choose when to work as long as they meet their targets.

10 How flexible is your workplace about where employees do their work?

Work is mostly done at the office. 1 ☐ 2 ☐ 3 ☐ 4 ☐ Work can be done at home or other non-office environments.

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3

11 Do you use a computer at work?

1 ☐ Yes
2 ☐ No

12 Is your computer PC or Mac?

1 ☐ PC
2 ☐ Mac

Please go to question 13

12.P.1 Which is your computer's microprocessor (CPU)?

| Intel | AMD |
|---|------------------------------------|
| 1 <input type="checkbox"/> Pentium, Pentium Pro, Pentium II | 5 <input type="checkbox"/> 586, K5 |
| 2 <input type="checkbox"/> Pentium MMX, Celeron | 6 <input type="checkbox"/> K6 |
| 3 <input type="checkbox"/> Pentium 3 | 7 <input type="checkbox"/> Athlon |
| 4 <input type="checkbox"/> Pentium 4, Celeron II, Duron | 8 <input type="checkbox"/> K7 |
| 9 <input type="checkbox"/> Other: <input style="width: 100%;" type="text"/> | |

12.M.1 What model is your computer?

1 ☐ PPC 601, PPC 603, PPC 620
2 ☐ G3
3 ☐ G4
4 ☐ G5
5 ☐ Other:

12.P.2 Which software and version of word processor is used at your workplace?

| Microsoft | Corel |
|---|---|
| 1 <input type="checkbox"/> Word 95, Word 97 | 5 <input type="checkbox"/> WordPerfect 7 or 8 |
| 2 <input type="checkbox"/> Word 2000 | 6 <input type="checkbox"/> WordPerfect 9 or 10 |
| 3 <input type="checkbox"/> Word 2002 | 7 <input type="checkbox"/> WordPerfect 11 or 12 |
| 4 <input type="checkbox"/> Word 2003 | 8 <input type="checkbox"/> WordPerfect X3 |
| 9 <input type="checkbox"/> Other: <input style="width: 100%;" type="text"/> <i>Please specify version.</i> | |

12.M.2 Which software and version of word processor is used at your workplace?

| Microsoft | Apple iWork |
|---|------------------------------------|
| 1 <input type="checkbox"/> Word 98 | 5 <input type="checkbox"/> Pages |
| 2 <input type="checkbox"/> Word 2001 | 6 <input type="checkbox"/> Pages 2 |
| 3 <input type="checkbox"/> Word v.X | |
| 4 <input type="checkbox"/> Word 2004 | |
| 7 <input type="checkbox"/> Other: <input style="width: 100%;" type="text"/> <i>Please specify version.</i> | |

13 Does your workplace have Internet connection?

1 ☐ Yes
5 ☐ No

☐ 2 Dial-Up, ISDN
☐ 3 Broadband (ADSL, Cable, Satellite)
☐ 4 Wireless
6 ☐ Other:

14 Does your company have a website?


1 ☐ Yes
2 ☐ No

15 Is there a wireless network at your workplace?

1 ☐ Yes
2 ☐ No

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16 What type of monitors are used at your workplace?

☐ 1 Only non flat panel (CRT) monitors
☐ 2 Mostly non flat panel (CRT) monitors
☐ 3 Mostly flat panel monitors
☐ 4 Only flat panel monitors

17 Which scenario best describes the adoption process of new technology in your workplace?

☐ 1 We adopt technology after everyone else in our field
☐ 2 We adopt technology after the average in our field
☐ 3 We adopt technology with the majority in our field
☐ 4 We adopt technology before anyone else in our field

18 Does your workplace rely more on faxes or e-mails to receive and send information?

☐ 1 E-mails

☐ 2 Faxes

18.E.1 Generally, non-spam e-mails, are:

☐ 1 Always printed
☐ 2 Commonly printed
☐ 3 Rarely printed
☐ 4 Never printed

18.F.1 Faxes are received:

☐ 1 Via a fax machine (hard copy)
☐ 2 Via a computer and never printed
☐ 3 Via a computer and rarely printed
☐ 4 Via a computer and commonly printed
☐ 5 Via a computer and always printed

19 Are hardcopy documents scanned?

☐ 1 Yes

☐ 2 No

20 Are there policies in your workplace to reduce the use of:


| | | | |
|---------------------------------|--------------------------------|---|-------------------------------|
| A) Electricity | <input type="checkbox"/> 1 Yes | <input type="checkbox"/> 2 Yes, but not properly followed | <input type="checkbox"/> 3 No |
| B) Water | <input type="checkbox"/> 1 Yes | <input type="checkbox"/> 2 Yes, but not properly followed | <input type="checkbox"/> 3 No |
| C) Paper | <input type="checkbox"/> 1 Yes | <input type="checkbox"/> 2 Yes, but not properly followed | <input type="checkbox"/> 3 No |
| D) Printers' ink / toner | <input type="checkbox"/> 1 Yes | <input type="checkbox"/> 2 Yes, but not properly followed | <input type="checkbox"/> 3 No |
| E) Use of cars | <input type="checkbox"/> 1 Yes | <input type="checkbox"/> 2 Yes, but not properly followed | <input type="checkbox"/> 3 No |

21 Rank the level of bureaucracy at your workplace

Procedures are relaxed ☐ 1 ☐ 2 ☐ 3 ☐ 4 Procedures must be strictly followed

22 Rank the level of competition at your workplace

Low ☐ 1 ☐ 2 ☐ 3 ☐ 4 High

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5

23 On average, how many hours do you work overtime on a fortnightly basis?
Extra time is considered more than 75hrs per fortnight for full-time employees and 40hrs for part-time.

1 ☐ 0 2 ☐ 1-5 3 ☐ 6-10 4 ☐ 11-15 5 ☐ 16-20 6 ☐ 21-25 7 ☐ 26-30 8 ☐ 31+

24 Does your workplace have implemented alternative ways of working?

1 ☐ Yes, please specify
 2 ☐ **Hot-desking:** A desk is used by more than one person at different times.
 3 ☐ **Teleworking:** Working outside the office environment.
 4 Other:

5 ☐ No

24.Y.1 Do you personally work in the above selected arrangement?
1 ☐ Yes 2 ☐ No

24.N.1 Could most of your work be done outside an office environment?
1 ☐ Yes 2 ☐ No

24.Y.2 Which pros and cons have you experienced as a consequence of adopting alternative ways of working?

24.N.2 Which do you think would be the most common pros and cons of adopting alternative ways of working?

Tick all applicable

| Pros | Cons |
|--|--|
| 1.p <input type="checkbox"/> More free time | 1.c <input type="checkbox"/> Isolation |
| 2.p <input type="checkbox"/> Increased productivity | 2.c <input type="checkbox"/> Longer working hours |
| 3.p <input type="checkbox"/> Less commuting time | 3.c <input type="checkbox"/> Lack of motivation |
| 4.p <input type="checkbox"/> Free-up office space | 4.c <input type="checkbox"/> Lack of privacy |
| 5.p <input type="checkbox"/> Other: <input type="text"/> | 5.c <input type="checkbox"/> Other: <input type="text"/> |

25 On average how much time takes you to get to work? (Return)

Hrs Min

26 How do you get to your workplace?

1 ☐ By foot / Bicycle 3 ☐ Scooter / Motorcycle
 2 ☐ Public transport 4 ☐ Car

27 How many people work at your company? (Including yourself)

| Work mainly at the office / workplace | Work mainly from outside the office / workplace |
|--|--|
| Full time: <input type="text"/> | <input type="text"/> |
| Part time: <input type="text"/> | <input type="text"/> |

THANK YOU!

Please insert the questionnaire into the provided pre-paid envelope and send it to:

RMIT University
 GPO Box 2476V
 Melbourne VIC 3001
 School of Property,
 Construction and Project Management
 Attention: Agustin Chevez

TEST-QUESTIONNAIRE ASSESSMENT FORM 1/1

QUESTIONNAIRE ASSESSMENT FORM

*Please take some few more minutes to assess and help improve the questionnaire.
Your candid input is extremely valuable.
Tick the box next to your preferred answer.*

1) Approximate time to complete the questionnaire (in minutes): _____

2) Do you find the questionnaire easy to answer?

☐ Yes ☐ No

3) Do you find the questionnaire confusing?

☐ Yes ☐ No

4) Do questions seem to fit together?

☐ Yes ☐ No

5) Do you find the questionnaire cluttered?

☐ Yes ☐ No

6) Do you like the overall design of the questionnaire?

☐ Yes ☐ No

7) Do you find the questionnaire interesting?

☐ Yes ☐ No

8) Which questions do you find difficult to answer? (Circle all applicable)

1 2 3 4 5 6 7 8 9 10 11 12 12.P.1 12.M.1 12.P.2
12.M.2 13 14 15 16 17 18 18.E.1 18.F.1 19 20 21 22
23 24 24.Y.1 24.N.1 24.Y.2 24.N.2 25 26 27

9) Which questions do you feel to say more? (Circle all applicable)

1 2 3 4 5 6 7 8 9 10 11 12 12.P.1 12.M.1 12.P.2
12.M.2 13 14 15 16 17 18 18.E.1 18.F.1 19 20 21 22
23 24 24.Y.1 24.N.1 24.Y.2 24.N.2 25 26 27

10) Do you feel that the questionnaire is too long?

☐ Yes ☐ No

11) How would you improve the questionnaire?

*Please insert the completed **QUESTIONNAIRE and ASSESSMENT FORM** in the envelope provided and mail it at your soonest convenience.*

Thank you for your time!

Reliability analysis tables

This appendix contains the tables used for the reliability assessment analysis discussed in Chapter 5. Groups A to D refer to groups of respondents from the same company. It is worth noting that Group A and Group B of the test (Chapter 5) are not the same as Groups A and B from Chapter 7 Survey.

Refer to section 5.5 *Reliability of the research instrument* for a detailed explanation of these tables.

GROUP A (TEST)

STATISTICAL ANALYSIS: GROUP A

| | 1.A | 1.B | 1.C | 1.D | 1.E | 1.F | 1.G | 1.H | 1.I | 1.J | 1.K | 1.L | 1.M | 1.N |
|--------------------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|--------|-------|--------|-------|
| Mean | 3.625 | 3.125 | 3.125 | 3.875 | 3.125 | 2.750 | 1.625 | 3.125 | 3.125 | 3.875 | 2.750 | 3.000 | 3.250 | 3.375 |
| Standard Error | 0.183 | 0.227 | 0.227 | 0.125 | 0.227 | 0.366 | 0.183 | 0.125 | 0.125 | 0.125 | 0.366 | 0.267 | 0.313 | 0.183 |
| Median | 4 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 4 | 3 | 3 | 3.5 | 3 |
| Mode | 4 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 4 | 3 | 3 | 4 | 3 |
| Standard Deviation | 0.518 | 0.641 | 0.641 | 0.354 | 0.641 | 1.035 | 0.518 | 0.354 | 0.354 | 0.354 | 1.035 | 0.756 | 0.886 | 0.518 |
| Sample Variance | 0.268 | 0.411 | 0.411 | 0.125 | 0.411 | 1.071 | 0.268 | 0.125 | 0.125 | 0.125 | 1.071 | 0.571 | 0.786 | 0.268 |
| Skewness | -0.644 | -0.068 | -0.068 | -2.828 | -0.068 | -0.386 | -0.644 | 2.828 | 2.828 | -2.828 | -0.386 | 0.000 | -0.615 | 0.644 |
| Range | 1 | 2 | 2 | 1 | 2 | 3 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 1 |

| | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | 14 | 15 | 16 | 17 |
|--------------------|-------|-------|-------|-------|--------|--------|-------|-------|-------|-------|--------|--------|
| Mean | 2.375 | 2.000 | 1.875 | 2.250 | 1.875 | 2.750 | 2.000 | 1.000 | 2.000 | 2.000 | 3.125 | 2.750 |
| Standard Error | 0.183 | 0.000 | 0.227 | 0.250 | 0.125 | 0.412 | 0.378 | 0.000 | 0.000 | 0.000 | 0.350 | 0.164 |
| Median | 2 | 2 | 2 | 2 | 2 | 2.5 | 2 | 1 | 1 | 2 | 3 | 3 |
| Mode | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 3 |
| Standard Deviation | 0.518 | 0.000 | 0.641 | 0.707 | 0.354 | 1.165 | 1.069 | 0.000 | 0.000 | 0.000 | 0.991 | 0.463 |
| Sample Variance | 0.268 | 0.000 | 0.411 | 0.500 | 0.125 | 1.357 | 1.143 | 0.000 | 0.000 | 0.000 | 0.982 | 0.214 |
| Skewness | 0.644 | 0 | 0.068 | 2.828 | -2.828 | -0.090 | 0.935 | | | | -1.486 | -1.440 |
| Range | 1 | 0 | 2 | 2 | 1 | 3 | 3 | 0 | 0 | 0 | 3 | 1 |

| | 18 | 19 | 20.A | 20.B | 20.C | 20.D | 20.E | 21 | 22 |
|--------------------|----|--------|--------|--------|--------|--------|--------|-------|-------|
| Mean | 1 | 1.625 | 2.625 | 2.500 | 1.625 | 2.625 | 2.875 | 2.250 | 2.000 |
| Standard Error | 0 | 0.183 | 0.183 | 0.267 | 0.183 | 0.183 | 0.125 | 0.164 | 0.378 |
| Median | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| Mode | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| Standard Deviation | 0 | 0.518 | 0.518 | 0.756 | 0.518 | 0.518 | 0.354 | 0.463 | 1.069 |
| Sample Variance | 0 | 0.268 | 0.268 | 0.571 | 0.268 | 0.268 | 0.125 | 0.214 | 1.143 |
| Skewness | | -0.644 | -0.644 | -1.323 | -0.644 | -0.644 | -2.828 | 1.440 | 0.935 |
| Range | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 |

HOMOGENITY GROUPING CRITERIA

| | 4 | 3 | | | 2 | 1 | | | | 0 |
|-----------------------|-------------------|-----------------------------|-------|----------|--|---------------|--------|--------|--------|-------------------------|
| | | a | b | c | | a | b | c | d | |
| Standard Error | 0 | 0.125 | 0.25 | 0.164 | 0.183 | 0.227 | 0.267 | 0.267 | 0.313 | >0.4 |
| Standard Deviation | 0 | 0.354 | 0.707 | 0.463 | 0.518 | 0.641 | 0.756 | 0.756 | 0 | >0.8 |
| Sample Variance | 0 | 0.125 | 0.5 | 0.214 | 0.268 | 0.411 | 0.0571 | 0.571 | 0.886 | >0.6 |
| Skewness | N/A | -2.828 | 2.828 | +/-1.44 | -0.644 | 0.068 | 0 | -1.323 | -0.615 | varies |
| Range | 0 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| Questions under group | 4, 11, 14, 15, 18 | 1.D, 1.H, 1.I, 1.J, 7, 20.E | 6 | 20.E, 21 | 1.A, 1.G, 1.N, 3, 19, 20.A, 20.C, 20.D | 1.B, 1.C, 1.L | 20.B | 1.M | | 1.F, 1.K, 9, 10, 16, 22 |

GROUP B (TEST)

STATISTICAL ANALYSIS: GROUP B

| | 1.A | 1.B | 1.C | 1.D | 1.E | 1.F | 1.G | 1.H | 1.I | 1.J | 1.K | 1.L | 1.M | 1.N |
|--------------------|--------|-------|-------|--------|--------|-------|-------|-------|--------|--------|-------|-------|--------|-------|
| Mean | 2.333 | 2.000 | 2.333 | 2.667 | 2.333 | 1.667 | 1.333 | 3.000 | 2.333 | 3.333 | 2.333 | 3.000 | 2.667 | 3.000 |
| Standard Error | 0.667 | 0.000 | 0.333 | 0.882 | 0.667 | 0.667 | 0.333 | 0.000 | 0.667 | 0.667 | 0.882 | 0.000 | 0.882 | 0.577 |
| Median | 3 | 2 | 2 | 3 | 3 | 1 | 1 | 3 | 3 | 4 | 2 | 3 | 3 | 3 |
| Mode | 3 | 2 | 2 | | 3 | 1 | 1 | 3 | 3 | 4 | 2 | 3 | | |
| Standard Deviation | 1.155 | 0.000 | 0.577 | 1.528 | 1.155 | 1.155 | 0.577 | 0.000 | 1.155 | 1.155 | 1.528 | 0.000 | 1.528 | 1.000 |
| Sample Variance | 1.333 | 0.000 | 0.333 | 2.333 | 1.333 | 1.333 | 0.333 | 0.000 | 1.333 | 1.333 | 2.333 | 0.000 | 2.333 | 1.000 |
| Skewness | -1.732 | | 1.732 | -0.935 | -1.732 | 1.732 | 1.732 | | -1.732 | -1.732 | 0.935 | | -0.935 | 0.000 |
| Range | 2 | 0 | 1 | 3 | 2 | 2 | 1 | 0 | 2 | 2 | 3 | 0 | 3 | 2 |

| | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | 14 | 15 | 16 | 17 |
|--------------------|-------|-------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|
| Mean | 2.000 | 2.000 | 1.000 | 2.333 | 2.000 | 1.667 | 1.333 | 1.000 | 1.333 | 1.667 | 3.000 | 2.333 |
| Standard Error | 0.000 | 0.000 | 0.000 | 0.333 | 0.000 | 0.333 | 0.333 | 0.000 | 0.333 | 0.333 | 0.000 | 0.333 |
| Median | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 2 |
| Mode | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 2 |
| Standard Deviation | 0.000 | 0.000 | 0.000 | 0.577 | 0.000 | 0.577 | 0.577 | 0.000 | 0.577 | 0.577 | 0.000 | 0.577 |
| Sample Variance | 0.000 | 0.000 | 0.000 | 0.333 | 0.000 | 0.333 | 0.333 | 0.000 | 0.333 | 0.333 | 0.000 | 0.333 |
| Skewness | | | | 1.732 | | -1.732 | 1.732 | | 1.732 | -1.732 | | 1.732 |
| Range | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |

| | 18 | 19 | 20.A | 20.B | 20.C | 20.D | 20.E | 21 | 22 |
|--------------------|-------|-------|-------|-------|-------|--------|-------|-------|-------|
| Mean | 1.333 | 1.333 | 3.000 | 3.000 | 2.000 | 2.667 | 3.000 | 2.000 | 2.000 |
| Standard Error | 0.333 | 0.333 | 0.000 | 0.000 | 0.577 | 0.333 | 0.000 | 0.000 | 0.000 |
| Median | 1 | 1 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| Mode | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Standard Deviation | 0.577 | 0.577 | 0.000 | 0.000 | 1.000 | 0.577 | 0.000 | 0.000 | 0.000 |
| Sample Variance | 0.333 | 0.333 | 0.000 | 0.000 | 1.000 | 0.333 | 0.000 | 0.000 | 0.000 |
| Skewness | 1.732 | 1.732 | | | 0.000 | -1.732 | | | |
| Range | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |

HOMOGENITY GROUPING CRITERIA

| | 4 | 3 | 2 | 1 | 0 |
|-----------------------|---|----------------------------------|-------------------------|------------|--------------------------|
| Standard Error | 0 | 0.333 | 0.667 | 0.333 | varies |
| Standard Deviation | 0 | 0.577 | 1.155 | 0.577 | varies |
| Sample Variance | 0 | 0.333 | 1.333 | 0.333 | varies |
| Skewness | N/A | +/-1.732 | -1.732 | +/-1.732 | varies |
| Range | 0 | 1 | 2 | 1 | >=2 |
| Questions under group | 1.B, 1.H, 1.L, 3, 4, 5, 7, 11, 16, 20.A, 20.B, 20.E, 21, 22 | 1.C, 1.G, 6, 9, 10, 17, 18, 20.D | 1.A, 1.E, 1.F, 1.I, 1.J | 14, 15, 19 | 1.D, 1.K, 1.M, 1.N, 20.C |

GROUP C (TEST)

STATISTICAL ANALYSIS: GROUP C

| | 1.A | 1.B | 1.C | 1.D | 1.E | 1.F | 1.G | 1.H | 1.I | 1.J | 1.K | 1.L | 1.M | 1.N |
|--------------------|--------|-------|-------|-------|--------|--------|--------|-------|-------|-------|-------|-------|--------|-------|
| Mean | 2.400 | 2.000 | 1.600 | 1.800 | 2.400 | 2.600 | 2.400 | 3.000 | 2.000 | 1.800 | 2.200 | 2.400 | 3.200 | 1.800 |
| Standard Error | 0.400 | 0.548 | 0.400 | 0.374 | 0.400 | 0.678 | 0.600 | 0.316 | 0.447 | 0.490 | 0.583 | 0.678 | 0.583 | 0.490 |
| Median | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 4 | 1 |
| Mode | 3 | 1 | 1 | 2 | 3 | 4 | 3 | 3 | 3 | 1 | 1 | 4 | 4 | 1 |
| Standard Deviation | 0.894 | 1.225 | 0.894 | 0.837 | 0.894 | 1.517 | 1.342 | 0.707 | 1.000 | 1.095 | 1.304 | 1.517 | 1.304 | 1.095 |
| Sample Variance | 0.800 | 1.500 | 0.800 | 0.700 | 0.800 | 2.300 | 1.800 | 0.500 | 1.000 | 1.200 | 1.700 | 2.300 | 1.700 | 1.200 |
| Skewness | -1.258 | 1.361 | 1.258 | 0.512 | -1.258 | -0.315 | -0.166 | 0.000 | 0.000 | 0.609 | 0.541 | 0.315 | -1.714 | 0.609 |
| Range | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |

| | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | 14 | 15 | 16 | 17 |
|--------------------|-------|-------|--------|--------|-------|--------|-------|-------|-------|-------|--------|--------|
| Mean | 3.000 | 1.000 | 1.600 | 1.800 | 1.200 | 3.800 | 3.400 | 1.000 | 1.000 | 1.200 | 2.200 | 2.600 |
| Standard Error | 0.000 | 0.316 | 0.245 | 0.583 | 0.200 | 0.200 | 0.245 | 0.000 | 0.000 | 0.200 | 0.374 | 0.245 |
| Median | 3 | 1 | 2 | 2 | 1 | 4 | 3 | 1 | 1 | 1 | 2 | 3 |
| Mode | 3 | 1 | 2 | 3 | 1 | 4 | 3 | 1 | 1 | 1 | 3 | 3 |
| Standard Deviation | 0.000 | 0.707 | 0.548 | 1.304 | 0.447 | 0.447 | 0.548 | 0.000 | 0.000 | 0.447 | 0.837 | 0.548 |
| Sample Variance | 0.000 | 0.500 | 0.300 | 1.700 | 0.200 | 0.200 | 0.300 | 0.000 | 0.000 | 0.200 | 0.700 | 0.300 |
| Skewness | | 0.000 | -0.609 | -0.541 | 2.236 | -2.236 | 0.609 | | | 2.236 | -0.512 | -0.609 |
| Range | 0 | 2 | 1 | 3 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 1 |

| | 18 | 19 | 20.A | 20.B | 20.C | 20.D | 20.E | 21 | 22 |
|--------------------|-------|--------|--------|--------|--------|--------|-------|-------|--------|
| Mean | 1.000 | 1.600 | 2.000 | 2.000 | 1.800 | 1.800 | 1.600 | 2.800 | 2.200 |
| Standard Error | 0.000 | 0.245 | 0.632 | 0.632 | 0.583 | 0.583 | 0.600 | 0.374 | 0.374 |
| Median | 1 | 2 | 3 | 3 | 2 | 2 | 1 | 3 | 2 |
| Mode | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| Standard Deviation | 0.000 | 0.548 | 1.414 | 1.414 | 1.304 | 1.304 | 1.342 | 0.837 | 0.837 |
| Sample Variance | 0.000 | 0.300 | 2.000 | 2.000 | 1.700 | 1.700 | 1.800 | 0.700 | 0.700 |
| Skewness | | -0.609 | -0.884 | -0.884 | -0.541 | -0.541 | 0.166 | 0.512 | -0.512 |
| Range | 0 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |

HOMOGENITY GROUPING CRITERIA

| | 4 | 3 | | | 2 | | | 1 | | | | | | | 0 | |
|-----------------------|---------------|----------|-------|--------|---------------|-----------|-------|-------|-----------------|-------|--------|--------|------------|------------|--------|------------------------------------|
| | | a | b | c | a | b | c | a | b | c | d | e | f | g | | h |
| Standard Error | 0 | 0.200 | 0.316 | 0.245 | 0.400 | 0.245 | 0.200 | 0.548 | 0.374 | 0.490 | 0.583 | 0.245 | 0.583 | 0.632 | 0.583 | varies |
| Standard Deviation | 0 | 0.447 | 0.707 | 0.548 | 0.894 | 0.548 | 0.447 | 1.225 | 0.837 | 1.095 | 1.304 | 0.548 | 1.304 | 1.414 | 1.304 | varies |
| Sample Variance | 0 | 0.200 | 0.500 | 0.300 | 0.800 | 0.300 | 0.200 | 1.500 | 0.700 | 1.200 | 1.700 | 0.300 | 1.700 | 2.000 | 1.700 | varies |
| Skewness | N/A | +/-2.236 | 0.000 | -0.609 | +/-1.258 | +/-0.609 | 2.236 | 1.361 | +/-0.512 | 0.609 | -0.541 | -0.609 | -0.541 | -0.884 | -1.714 | varies |
| Range | 0 | 1 | 2 | 1.000 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | varies |
| Questions under group | 3, 11, 14, 18 | 7,9 | 1.H | 5 | 1.A, 1.C, 1.E | 4, 10, 17 | 15 | 1.B | 1.D, 16, 21, 22 | 1.J | 6 | 19 | 20.C, 20.D | 20.A, 20.B | 1.M | 1.F, 1.G, 1.I, 1.K, 1.L, 1.N, 20.E |

GROUP D (TEST)

STATISTICAL ANALYSIS: GROUP D

| | 1.A | 1.B | 1.C | 1.D | 1.E | 1.F | 1.G | 1.H | 1.I | 1.J | 1.K | 1.L | 1.M | 1.N |
|--------------------|-------|-------|-------|-------|--------|-------|-------|--------|--------|--------|-------|-------|--------|--------|
| Mean | 2.500 | 2.500 | 2.250 | 2.500 | 2.250 | 2.500 | 2.500 | 2.750 | 2.250 | 2.250 | 2.250 | 1.750 | 1.750 | 1.750 |
| Standard Error | 0.289 | 0.500 | 0.629 | 0.645 | 0.479 | 0.289 | 0.289 | 0.629 | 0.479 | 0.479 | 0.250 | 0.479 | 0.250 | 0.250 |
| Median | 2.5 | 2 | 2 | 2.5 | 2.5 | 2.5 | 3 | 3 | 2.5 | 3 | 1 | 1.5 | 2 | 2 |
| Mode | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 |
| Standard Deviation | 0.577 | 1.000 | 1.258 | 1.291 | 0.957 | 0.577 | 0.577 | 1.258 | 0.957 | 0.957 | 0.500 | 0.957 | 0.500 | 0.500 |
| Sample Variance | 0.333 | 1.000 | 1.583 | 1.667 | 0.917 | 0.333 | 0.333 | 1.583 | 0.917 | 0.917 | 0.250 | 0.917 | 0.250 | 0.250 |
| Skewness | 0.000 | 2.000 | 1.129 | 0.000 | -0.855 | 0.000 | 0.000 | -1.129 | -0.855 | -0.855 | 2.000 | 0.855 | -2.000 | -2.000 |
| Range | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |

| | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | 14 | 15 | 16 | 17 |
|--------------------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
| Mean | 1.000 | 1.250 | 1.000 | 2.000 | 1.750 | 1.250 | 1.000 | 1.000 | 1.500 | 2.000 | 2.250 | 1.500 |
| Standard Error | 0.000 | 0.250 | 0.000 | 0.000 | 0.250 | 0.250 | 0.000 | 0.000 | 0.289 | 0.000 | 0.250 | 0.289 |
| Median | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1.5 | 2 | 2 | 1.5 |
| Mode | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Standard Deviation | 0.000 | 0.500 | 0.000 | 0.000 | 0.500 | 0.500 | 0.000 | 0.000 | 0.577 | 0.000 | 0.500 | 0.577 |
| Sample Variance | 0.000 | 0.250 | 0.000 | 0.000 | 0.250 | 0.250 | 0.000 | 0.000 | 0.333 | 0.000 | 0.250 | 0.333 |
| Skewness | 0 | 2.000 | | | -2.000 | 2.000 | | | 0.000 | | 2.000 | 0.000 |
| Range | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |

| | 18 | 19 | 20.A | 20.B | 20.C | 20.D | 20.E | 21 | 22 |
|--------------------|-------|-------|--------|--------|-------|--------|--------|-------|-------|
| Mean | 1.250 | 2.000 | 2.750 | 2.750 | 2.250 | 2.750 | 2.750 | 4.000 | 1.500 |
| Standard Error | 0.250 | 0.000 | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.000 | 0.289 |
| Median | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 4 | 1.5 |
| Mode | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 4 | 2 |
| Standard Deviation | 0.500 | 0.000 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.000 | 0.577 |
| Sample Variance | 0.250 | 0.000 | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.000 | 0.333 |
| Skewness | 2.000 | | -2.000 | -2.000 | 2.000 | -2.000 | -2.000 | | 0.000 |
| Range | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |

HOMOGENITY GROUPING CRITERIA

| | 4 | 3 | | | 2 | | | 1 | | | 0 |
|-----------------------|-----------------------------|---|-------|-----------------------|-------|-------|---------------|----------|----------|---------|--------|
| | | a | b | | a | b | c | a | b | c | |
| Standard Error | 0 | 0.250 | 0.250 | 0.289 | 0.250 | 0.500 | 0.500 | 0.479 | 0.629 | 0.479 | varies |
| Standard Deviation | 0 | 0.500 | 0.500 | 0.577 | 0.500 | 0.577 | 1.000 | 0.957 | 1.258 | 0.957 | varies |
| Sample Variance | 0 | 0.500 | 0.250 | 0.333 | 0.250 | 0.333 | 1.000 | 0.917 | 1.583 | 0.917 | varies |
| Skewness | N/A | +/-2 | +/-2 | 0 | 2.000 | 2.000 | 2.000 | -0.855 | +/-1.129 | -0.855 | varies |
| Range | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | varies |
| Questions under group | 3, 5, 6, 10, 11, 15, 19, 21 | 16, 18, 20.A, 20.B, 20.C, 20.D, 20.E, 1.K, 1.M, 1.N | 7,9 | 1.A, 1.F, 1.G, 17, 22 | 4 | 1.B | 1.1, 1.J, 1.L | 1.C, 1.H | 1.E | 1.D, 14 | |

Appendix 6a

Survey Kit:

Cover letter 1 (Initial contact)

Cover letter 2 (reminder-Final contact)

Questionnaire

COVER LETTER 1

**PRINTED ON RMIT University (School of Property, Construction and Project Management)
Letterhead paper**

<Company Name>
<Company Address Line 1>
<Company Address Line 2>

<Questionnaire ID>

<Date>

Dear Sir / Madame,

My name is Agustin Chevez. I am undertaking a PhD at the School of Property Construction and Project Management at RMIT University. The title of my research is "*Evolution of workplace architecture as a consequence of technology development*".

Your company is invited to participate in this research and help to better understand how technology is changing workplace architecture. This research focuses on future office space requirements and our interaction with it.

Your company was drawn through a random sampling process in which companies in your field had an equal chance of being selected. Since the sample size is kept to the minimum, the success of this research depends on your participation.

The questionnaire can be completed by anyone in the company. The questionnaire has been designed to be completed in approximately 10 minutes. All information that you provide on this survey is strictly confidential. Your company will not be identified. The data provided is for the purpose of research only. You are free to withdraw from the research at any time and to withdraw any unprocessed data previously supplied. Only participants of 18 years of age or older can participate in this study.

After completing the questionnaire, please place it inside the pre-paid and self-addressed envelope provided and mail it at your soonest convenience.

Thank you for your assistance!

If you have any questions please contact the undersigned or:

Dr. Guillermo Aranda-Mena
Research Supervisor
RMIT University - School of Property Construction and Project Management
e-mail: guillermo.aranda-mena@rmit.edu.au

Yours faithfully,

(Signed)

Agustin Chevez
PhD Candidate - RMIT University
e-mail: s3032925@student.rmit.edu.au

encl.: Questionnaire and pre-paid self-addressed envelope

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

COVER LETTER 2

PRINTED ON RMIT University (School of Property, Construction and Project Management)
Letterhead paper

<Company Name>

<Company Address Line 1>

<Company Address Line 2>

<Questionnaire ID>

<Date>

Dear Sir / Madame,

A couple of weeks ago I invited your company to be part of the research "*Evolution of workplace architecture as a consequence of technology development*" which I am doing as part of my PhD at the School of Property Construction and Project Management at RMIT University. This is a gentle reminder that we have not yet received your completed survey. **Your response is very important to the success of this research.**

Your participation will greatly help to understand the effect of technology in workplace architecture.

The questionnaire can be completed by anyone in the company. The questionnaire has been designed to be completed in approximately 10 minutes. All information that you provide on this survey is strictly confidential. Your name and company will not be identified. The data provided is for the purpose of research only. You are free to withdraw from the research at any time and to withdraw any unprocessed data previously supplied. Only participants of 18 years of age or older can participate in this study.

After completing the questionnaire, please place it inside the pre-paid and self-addressed envelope provided and mail it at your soonest convenience.

Thank you for your assistance!

If you have any questions please contact the undersigned or:

Dr. Guillermo Aranda-Mena
Research Supervisor
RMIT University - School of Property Construction and Project Management
e-mail: guillermo.aranda-mena@rmit.edu

Yours faithfully,

(Signed)

Agustin Chevez

PhD Candidate - RMIT University
e-mail: s3032925@student.rmit.edu.au

encl.: Questionnaire and pre-paid self-addressed envelope

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

QUESTIONNAIRE PAGE 1/4

QUESTIONNAIRE

1

Please tick the box ☒ next to your preferred answer.

Thank you for your co-operation!

ID:

The identification number on the questionnaire is for monitoring and analysis purposes only. Your name and company will not be associated with the answers you give.

1 In what type of building is your office located?

1 ☐ Adapted home / apartment unit
 2 ☐ Adapted warehouse or other non-office building
 3 ☐ Office building or building designed for the organisation's activities

2 Evaluate the following parameters at your workplace:

| | | | |
|---|----------|---|-------|
| A) Temperature comfort | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| B) Ventilation comfort | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| C) Illumination comfort | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| D) Background noise level | Noisy | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Quiet |
| E) Frequency of distractions | Frequent | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Rare |
| F) Visual privacy at your workstation | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| G) Voice privacy at your workstation | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| H) General spatial arrangement | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| I) General furniture arrangement | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| J) General office size | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| K) General office storage space | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| L) Individual storage space | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| M) Work space available on workstation | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |
| N) Overall space environment satisfaction | Poor | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> | Good |

3 Which layout best describes your workplace?

1 ☐ **Enclosed:** Consists of individual rooms (full height walls) with a corridor for access
 2 ☐ **Open-plan:** No internal walls or fixed partitions, space is divided by workstations

4 On average, you are at your desk / workstation:

Rarely 1 ☐ 2 ☐ 3 ☐ 4 ☐ Most of the time

5 Approximate percentage of time you spend in the following working modes: (Should add to 100%)

1 % Individual work, and quiet thinking
 2 % Face-to-face collaboration
 3 % Building relationships, and socialising


QUESTIONNAIRE PAGE 2/4

| | | | | | |
|----|--|----------------------------|--------------------------------|----------------------------|---|
| | | 1 | | 2 | |
| 6 | Which is the place where most productive work related interaction is done? | | | | |
| | <input type="checkbox"/> Meeting rooms <input type="checkbox"/> Each other's workstation / office <input type="checkbox"/> Informal environment within the office (Cafeteria / kitchen, etc) <input type="checkbox"/> Somewhere outside the office (Coffee shop, etc) | | | | |
| 7 | How flexible is your workplace about <u>when</u> employees do their work? | | | | |
| | Employees must work within a specific time frame | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Employees can choose when to work as long as they meet their targets |
| 8 | How flexible is your workplace about <u>where</u> employees do their work? | | | | |
| | Work must be done at the office | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Work may be done anywhere (home or other non-office environment) |
| 9 | How important is face-to-face interaction with workmates in daily activities? | | | | |
| | No face-to-face interaction is required | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Face to face interaction is essential in our daily activities |
| 10 | Rank the level of bureaucracy at your workplace | | | | |
| | Procedures are relaxed | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Procedures must be strictly followed |
| 11 | Rank the level of interpersonal-competitiveness at your workplace | | | | |
| | Low | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> High |
| 12 | How much do you depend on a computer for your daily work? | | | | |
| | I do not need a computer to do my work | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> I could not do my work without a computer |
| 13 | On average, how many hours do you work <u>per week</u>? | | | | Hrs / per week |
| 14 | Do you take work home? | | | | |
| | Never | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Everyday |
| | | | | | 5 <input type="checkbox"/> I work from home (Teleworker) |
| 15 | Do you work on weekends? | | | | |
| | Never | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> Every weekend |
| 16 | Are you happy with your work / life balance? | | 1 <input type="checkbox"/> Yes | | 2 <input type="checkbox"/> No |

QUESTIONNAIRE PAGE 3/4

| | | | |
|--|--|---|-----------------------------|
| | | 3 | |
| 17 | What type of computer do you have at work? | | |
| <input type="checkbox"/> Desktop / non-portable <input type="checkbox"/> Laptop / portable <input type="checkbox"/> I do not have a computer | | | |
| 18 | Does your workplace have Internet connection? | | |
| If <u>Yes</u> , please specify: <input type="checkbox"/> No <input type="checkbox"/> Dial-Up <input type="checkbox"/> Broadband <input type="checkbox"/> Wireless | | | |
| 19 | Does your company have a website? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 20 | Is there a wireless network at your workplace? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 21 | What type of monitors are used at your workplace? | | |
| Only CRT (non flat panel) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Only flat panel | | | |
| 22 | Which scenario best describes the adoption of new technology in your workplace? | | |
| We adopt technology <u>after</u> everyone else in our field <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> We adopt technology <u>before</u> the majority in our field | | | |
| 23 | Does your workplace rely more on faxes or e-mails to receive and send information? | | |
| E-mails <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Faxes | | | |
| 24 | Generally, non-spam e-mails, are: | | |
| Always printed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Never printed | | | |
| 25 | Are hardcopy documents scanned? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 26 | Are there policies in your workplace to reduce the use of: | | |
| A) Electricity | <input type="checkbox"/> Yes | <input type="checkbox"/> Yes, but not properly followed | <input type="checkbox"/> No |
| B) Water | <input type="checkbox"/> Yes | <input type="checkbox"/> Yes, but not properly followed | <input type="checkbox"/> No |
| C) Paper | <input type="checkbox"/> Yes | <input type="checkbox"/> Yes, but not properly followed | <input type="checkbox"/> No |
| D) Use of cars | <input type="checkbox"/> Yes | <input type="checkbox"/> Yes, but not properly followed | <input type="checkbox"/> No |
| 27 | Are desks / workstations shared in your office? (E.g Hot-desking) | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

QUESTIONNAIRE PAGE 4/4



28 Which of the following you have at HOME? *Tick all applicable*

☐ Computer ☐ Printer ☐ Fax ☐ Dial-up / ☐ Broadband / wireless Internet

29 Is teleworking (working from home) an option at your workplace?

If **Yes**, please specify:

1 ☐ I work from home days a week

2 ☐ I do not use this option, I rather go to the office

If **No**, please specify:

3 ☐ I would like to have the option of working from home

4 ☐ I rather go to the office

30 Which do you think are the pros and cons of working from home? *Tick all applicable*

| Pros | Cons |
|---|---|
| 1.p <input type="checkbox"/> More free time | 1.c <input type="checkbox"/> Isolation |
| 2.p <input type="checkbox"/> Increased productivity | 2.c <input type="checkbox"/> Longer working hours |
| 3.p <input type="checkbox"/> Less commuting time | 3.c <input type="checkbox"/> Lack of motivation |
| 4.p <input type="checkbox"/> Freeing up of office space | 4.c <input type="checkbox"/> Lack of a suitable environment at home |
| 5.p <input type="checkbox"/> More time with my family | 5.c <input type="checkbox"/> No boundaries between home and work |

31 On average, how much time does it take to commute? (Return)

1
Hrs
2
Min

32 On a typical day, which is your main way of transportation to get to work?

☐ By foot / Bicycle ☐ Public transport ☐ Scooter / Motorcycle ☐ Car

33 How many people work at your company? (Including yourself)

☐ 1-10 ☐ 11-20 ☐ 21-40 ☐ 41-60 ☐ 61-99 ☐ 100-150 ☐ 151+

34 Your age group

☐ 20's ☐ 30's ☐ 40's ☐ 50's ☐ 60's ☐ 70's +

35 Your gender

☐ Male ☐ Female

36 Your position in the company: (e.g. director, manager, sales, production, secretarial, etc.)

Please insert the questionnaire into the provided pre-paid envelope and send it at your soonest convenience.

THANK YOU!

Appendix 6b

Case Study A Kit:

Cover letter

Ethics form

Work Sampling Diary (WSD)

Refer to Appendix 6a for a sample of the questionnaire which was also included in this kit.

COVER LETTER

*PRINTED ON RMIT University (School of Property, Construction and Project Management)
Letterhead paper*

<Date>

Dear Sir / Madame,

My name is Agustin Chevez. I am undertaking a PhD at the School of Property Construction and Project Management at RMIT University. The title of my research is "*Evolution of workplace architecture as a consequence of technology development*".

Your company is invited to participate in this research and help to better understand how technology is changing workplace architecture. This research focuses on future office space requirements and our interaction with it.

Attached you will find:

- a) **Ethics form:** It is required that all participants read and sign the RMIT HUMAN RESEARCH ETHICS COMMITTEE form. Please keep a copy for your records and return the original.
- b) **Work sampling diary:** This booklet aims to capture your working habits during a full week (including weekends – if applicable). Please start using this booklet on Monday 22nd of October. The first three pages of the booklet provide instructions and examples on how to use it.
- c) **Questionnaire:** The questionnaire has been designed to be completed in approximately 10 minutes and it can be answered at any time during the sample week. Just remember to return it together with the work sampling diary and the ethics form.

All information that you provide on this survey is strictly confidential. Your company will not be identified. The data provided is for the purpose of research only. You are free to withdraw from the research at any time and to withdraw any unprocessed data previously supplied. Only participants of 18 years of age or older can participate in this study.

Thank you for your assistance!

If you have any questions please contact the undersigned or:

Dr. Guillermo Aranda-Mena
Research Supervisor
RMIT University - School of Property Construction and Project Management
e-mail: guillermo.aranda-mena@rmit.edu.au

Yours faithfully,

(Signed)

Agustin Chevez

PhD Candidate - RMIT University
e-mail: s3032925@student.rmit.edu.au

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

ETHICS FORM

RMIT HUMAN RESEARCH ETHICS COMMITTEE

Prescribed Consent form for persons participating in research projects involving tests administered to human subjects

PORTFOLIO OF DESIGN AND SOCIAL CONTEXT PORTAFOLIO
 SCHOOL/CENTRE SCHOOL OF PROPERTY CONSTRUCTION AND PROJECT MANAGEMENT

Name of participant: _____
 Project Title: Evolution of workplace architecture as a consequence of technology development

Name(s) of investigators: (1) Agustin Chevez Phone: 0402 369 585

Name of participant: _____

Project Title: **Evolution of workplace architecture as a consequence of technology development**

1. I have received a statement explaining the tests involved in this project and I consent to participate in the above project.
2. I authorise the investigator or his or her assistant to use with me the tests: Questionnaire and Work Sampling Diary.
3. I acknowledge that:
 - (a) The possible effects of the tests have been explained to me to my satisfaction.
 - (b) I have been informed that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).
 - (c) The project is for the purpose of research and/or teaching. It may not be of direct benefit to me.
 - (d) The privacy of the information I provide will be safeguarded. However should information of a private nature need to be disclosed for moral, clinical or legal reasons, I will be given an opportunity to negotiate the terms of this disclosure.
 - (e) The security of the research data is assured during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to the Cooperative Research Centre for Construction Innovation (CRC-CI). Any information which will identify me will not be used.

Participant's Consent

Name: _____ Date: _____
(Participant)

Name: _____ Date: _____
(Witness to signature)

Where participant is under 18 years of age:

I consent to the participation of _____ in the above project.

Signature: (1) _____ (2) _____ Date: _____
(Signatures of parents or guardians)

Name: _____ Date: _____
(Witness to signature)

Participants should be given a photocopy of this consent form after it has been signed.

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

Version #3: 3/20/2009

WSD PAGE 1/12

| | |
|--|---|
| | <div style="border: 1px solid black; padding: 5px;"><div style="background-color: #e0e0e0; height: 20px; margin-bottom: 5px;"></div><div>ID:</div><div style="font-size: 0.8em; margin-top: 5px;"><i>The identification number on the questionnaire is for analysis purposes only. Your name and company will not be associated with the answers you give.</i></div></div> |
| <h1>WORK SAMPLING DIARY</h1> <div style="display: flex; justify-content: center; gap: 20px;"><div style="text-align: center;">(Monday) From: 22 / OCT / 2007</div><div style="text-align: center;">To: 28 / OCT / 2007 (Sunday)</div></div> | |


WSD PAGE 2/12

| | |
|---|--|
| <h1>Instructions</h1> | |
| <p>Please use this diary to provide information about your working habits. It is very important that you do this on a <u>daily</u> basis.</p> <p>Note that:</p> <ul style="list-style-type: none">- The information that you provide will <u>not be</u> disclosed to your employer.- Your name will not be associated with the results.- Information will be presented in an aggregated fashion. <p>The following 2 pages are examples on how to fill in your diary. The first example is for weekdays and the next one for the weekend (if applicable).</p> <p>Please note that after the last day (Sunday) there is one more page for you to fill in. This page is very important because it helps to understand how representative is the information provided on this study week versus a typical week at work.</p> <p>When finish, please insert your completed diary, together with your completed survey, into the provided envelope.</p> <h2>Thank you for your participation!</h2> <p>Please contact Agustin Chevez on s3032925@student.rmit.edu.au should you have any questions.</p> | |
| <p>Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from : www.rmit.edu.au/council/hrec</p> | |

WSD PAGE 3/12

| | | | | | |
|---|---------|---------------------|--|--|--|
| | | | | MON DAY 1 | |
| Left home by: | 8:15 am | Arrived to work by: | 9:00 am | | |
| Had lunch from: | 1:00 pm | To: | 2:00 pm | | |
| <input checked="" type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | | | |
| Approximate percentage of time spent on: | | | Comments: | | |
| Quiet solo work | 15 | % | Out of office for 2hrs - meeting with client Today was a quiet day. Not too many phone calls. | | |
| Face-to-face meetings | 10 | % | | | |
| Telephone | 10 | % | | | |
| E-mail | 30 | % | | | |
| Outside the office | 35 | % | | | |
| Working day | 100% | | | | |
| I could have done today's work from home or other place outside the office | | | | | |
| Disagree <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Agree | | | | | |
| Left work by: | 5:00 pm | Took work home | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | |

WSD PAGE 4/12

| | | | | | |
|--|---------|-------|--|---------------------------------|--------------------------------|
| | | | | SAT DAY 6 | |
| ONLY FILL THIS PAGE IF APPLICABLE | | | | | |
| Hours worked: | 2.5 hrs | From: | <input checked="" type="checkbox"/> Home | <input type="checkbox"/> Office | <input type="checkbox"/> Other |
| Approximate percentage of time spent on: | | | Comments: | | |
| Quiet solo work | 10 | % | Reply to some outstanding e-mails. | | |
| Face-to-face meetings | - | % | | | |
| Telephone | | % | | | |
| E-mail | 90 | % | | | |
| Outside the office | | % | | | |
| Working day | 100% | | | | |
| If you did not work on the weekend please go to the last page.  | | | | | |

WSD PAGE 5/12

| | | | | | |
|--|--|----------------------|---------------------|------------------|--|
| | | | | MON DAY 1 | |
| Left home by: | | | Arrived to work by: | | |
| Had lunch from: | | | To: | | |
| <input type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | | | |
| Approximate percentage of time spent on: | | | Comments: | | |
| Quiet solo work | | <input type="text"/> | | | |
| | | % | | | |
| Face-to-face meetings | | <input type="text"/> | | | |
| | | % | | | |
| Telephone | | <input type="text"/> | | | |
| | | % | | | |
| E-mail | | <input type="text"/> | | | |
| | | % | | | |
| Outside the office | | <input type="text"/> | | | |
| | | % | | | |
| Working day | | 100% | | | |
| I could have done today's work from home or other place outside the office | | | | | |
| Disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Agree | | | | | |
| Left work by: | | | Took work home | | <input type="checkbox"/> Yes <input type="checkbox"/> No |

WSD PAGE 6/12

| | | | | | |
|--|--|----------------------|---------------------|------------------|--|
| | | | | TUE DAY 2 | |
| Left home by: | | | Arrived to work by: | | |
| Had lunch from: | | | To: | | |
| <input type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | | | |
| Approximate percentage of time spent on: | | | Comments: | | |
| Quiet solo work | | <input type="text"/> | | | |
| | | % | | | |
| Face-to-face meetings | | <input type="text"/> | | | |
| | | % | | | |
| Telephone | | <input type="text"/> | | | |
| | | % | | | |
| E-mail | | <input type="text"/> | | | |
| | | % | | | |
| Outside the office | | <input type="text"/> | | | |
| | | % | | | |
| Working day | | 100% | | | |
| I could have done today's work from home or other place outside the office | | | | | |
| Disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Agree | | | | | |
| Left work by: | | | Took work home | | <input type="checkbox"/> Yes <input type="checkbox"/> No |

WSD PAGE 7/12

| | | | | | |
|--|--|---------------------|--|--------------|--|
| | | WED | | DAY 3 | |
| Left home by: | | Arrived to work by: | | | |
| Had lunch from: | | To: | | | |
| <input type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | | | |
| Approximate percentage of time spent on: | | | Comments: | | |
| Quiet solo work | | % | | | |
| Face-to-face meetings | | % | | | |
| Telephone | | % | | | |
| E-mail | | % | | | |
| Outside the office | | % | | | |
| Working day | | 100% | | | |
| I could have done today's work from home or other place outside the office | | | | | |
| Disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Agree | | | | | |
| Left work by: | | Took work home | <input type="checkbox"/> Yes <input type="checkbox"/> No | | |


WSD PAGE 8/12

| | | | | | |
|--|--|---------------------|--|--------------|--|
| | | THU | | DAY 4 | |
| Left home by: | | Arrived to work by: | | | |
| Had lunch from: | | To: | | | |
| <input type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | | | |
| Approximate percentage of time spent on: | | | Comments: | | |
| Quiet solo work | | % | | | |
| Face-to-face meetings | | % | | | |
| Telephone | | % | | | |
| E-mail | | % | | | |
| Outside the office | | % | | | |
| Working day | | 100% | | | |
| I could have done today's work from home or other place outside the office | | | | | |
| Disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Agree | | | | | |
| Left work by: | | Took work home | <input type="checkbox"/> Yes <input type="checkbox"/> No | | |


WSD PAGE 9/12

| | | | | | |
|--|------|---------------------|--|--------------|--|
| | | FRI | | DAY 5 | |
| Left home by: | | Arrived to work by: | | | |
| Had lunch from: | | To: | | | |
| <input type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | | | |
| <u>Approximate</u> percentage of time spent on: | | | Comments: | | |
| Quiet solo work | | % | | | |
| Face-to-face meetings | | % | | | |
| Telephone | | % | | | |
| E-mail | | % | | | |
| Outside the office | | % | | | |
| Working day | 100% | | | | |
| I could have done today's work from home or other place outside the office | | | | | |
| Disagree <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Agree | | | | | |
| Left work by: | | Took work home | <input type="checkbox"/> Yes <input type="checkbox"/> No | | |

WSD PAGE 10/12

| | | | | | |
|---|------|------------|-------------------------------|---------------------------------|--------------------------------|
| | | SAT | | DAY 6 | |
| ONLY FILL THIS PAGE IF APPLICABLE | | | | | |
| Hours worked: | | From: | <input type="checkbox"/> Home | <input type="checkbox"/> Office | <input type="checkbox"/> Other |
| <u>Approximate</u> percentage of time spent on: | | | Comments: | | |
| Quiet solo work | | % | | | |
| Face-to-face meetings | | % | | | |
| Telephone | | % | | | |
| E-mail | | % | | | |
| Outside the office | | % | | | |
| Working day | 100% | | | | |
| If you did not work on the weekend please go to the last page.  | | | | | |

WSD PAGE 11/12

| | | SUN | | DAY 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------------|------------|-------------------------------|---------------------------------|---|--|--|--|-----------|--|--|-----------------|----------------------|---|--|--|--|-----------------------|----------------------|---|-----------|----------------------|---|--------|----------------------|---|--------------------|----------------------|---|-------------|--|------|--|--|--|
| ONLY FILL THIS PAGE IF APPLICABLE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hours worked: | | From: | <input type="checkbox"/> Home | <input type="checkbox"/> Office | <input type="checkbox"/> Other | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th colspan="3">Approximate percentage of time spent on:</th> <th colspan="3">Comments:</th> </tr> </thead> <tbody> <tr> <td>Quiet solo work</td> <td><input type="text"/></td> <td>%</td> <td colspan="3" rowspan="5"></td> </tr> <tr> <td>Face-to-face meetings</td> <td><input type="text"/></td> <td>%</td> </tr> <tr> <td>Telephone</td> <td><input type="text"/></td> <td>%</td> </tr> <tr> <td>E-mail</td> <td><input type="text"/></td> <td>%</td> </tr> <tr> <td>Outside the office</td> <td><input type="text"/></td> <td>%</td> </tr> <tr> <td>Working day</td> <td></td> <td>100%</td> <td colspan="3"></td> </tr> </tbody> </table> | | | | | | Approximate percentage of time spent on: | | | Comments: | | | Quiet solo work | <input type="text"/> | % | | | | Face-to-face meetings | <input type="text"/> | % | Telephone | <input type="text"/> | % | E-mail | <input type="text"/> | % | Outside the office | <input type="text"/> | % | Working day | | 100% | | | |
| Approximate percentage of time spent on: | | | Comments: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Quiet solo work | <input type="text"/> | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Face-to-face meetings | <input type="text"/> | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Telephone | <input type="text"/> | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E-mail | <input type="text"/> | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outside the office | <input type="text"/> | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Working day | | 100% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| If you did not work on the weekend please go to the last page. | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

WSD PAGE 12/12

| | |
|---|---|
| Please fill in the following | |
| <p>How representative was this week of an average week at work?</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div> | |
| <p>Please feel free to add any additional comment(s):</p> <div style="border: 1px solid black; height: 80px; width: 100%;"></div> | |
| Please insert your: a) Diary and b) Survey into the provided envelope and send it to: | Attention: <u>Agustin Chevez</u> School of Property, Construction and Project Management RMIT University GPO Box 2476V Melbourne VIC 3001 |
| THANK YOU ! | |

Case Study B Protocol:

Case Study B Preliminary Protocol-Second Places
Case Study B Preliminary Protocol-Nominated company
Instructions-Nominated company

Refer to Appendix 6a for a sample of the questionnaire which was also included in this kit.

Refer to Appendix 6b for a sample of the Ethics form and WSD which were also included in this kit.



Evolution of workplace architecture as a consequence of
technology development

Preliminary Case Study Protocol
Second Places

July 2008

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Appendix CSB-A: RMIT Ethics Consent form

Appendix CSB-B: Second Places Questionnaire and Nomination form (attachment)

Appendix CSB-C: Work Sampling Diary (WSD)

Appendix CSB-D: Survey

Appendix CSB-E: Report

Agustin Chevez Bernaldo de Quiros

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Preliminary Case Study Protocol – Case Study : Second Places

1. INTRODUCTION

Evolution of workplace architecture as a consequence of technology development is a PhD research currently undertaken by Agustin Chevez (the researcher) at RMIT University in Melbourne, Australia.

Following *Second Places* presentation at WorkTech in November 2007, the researcher engaged in a series of emails with the Director of the company to secure the opportunity to do a case study on *Second Places* and one of their clients in early September 2008.

The purpose of this document is to familiarise *Second Places* with the research and importance of this case study. Parallel, this document includes the case study timeline from end of July to the 5th of September (meeting in UK) and beyond (implementation of the case study). The most important outcome of this document will be the collection of information required from *Second Places* to develop the final Case Study protocol.

The completion of this case study will mark the end of the empirical data collection of the research. The research will be finished by September 2009.

1.1 Research sponsor

This research is sponsored by the [Cooperative Research Centre for Construction Innovation](#) (CRC-CI)

1.2 Research supervisors

- **Academy** ([RMIT University](#))
 - Dr. Guillermo Aranda-Mena
 - Prof. Peter Edwards
- **Industry** ([Woods Bagot](#))
 - James Calder

1.3 Contact details

In case of any doubt regarding this document and the research in general please contact:

Researcher:

Agustin Chevez
achbg@hotmail.com

Research supervisor:

Dr. Guillermo Aranda-Mena
guillermo.aranda-mena@rmit.edu.au

Agustin Chevez Bernaldo de Quiros

RMIT University
CRC-Construction Innovation

1







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Preliminary Case Study Protocol – Case Study : Second Places

2. BACKGROUND

The Information Technology Revolution is dramatically transforming the way most, if not all, sectors of society work, play, socialise together and undergo healing and recovery from illness. Almost every aspect of human endeavour is affected by technology change and with it the space requirements of those endeavours (Becker and Steele 1994; Castells 1996; Linturi 2000; Marmot and Eley 2000). Table 1 shows three strategic sectors of society: health, education and workplace in the early XX Century and in early XXI Century.

Table 1. Changes in health, education and workplace architecture

| | Health | Education | Workplace |
|-------------|---|---|---|
| XX Century |  <p>Operating room Luft, Potash et al. (2004)</p> |  <p>Traditional classroom Clayton (2005)</p> |  <p>Typists at a post office. Officemuseum.com (2005)</p> |
| XXI Century |  <p>Surgical Robot Butner and Ghodoussi (2003)</p> |  <p>Classroom Foote (2004)</p> |  <p>Workstations Knoll (2008)</p> |

From the above table it is clear that these spaces, as many others, have undergone a dramatic change in, both, their space requirements and the way we interact and behave in them. Vitruvius, in his treatise *De architectura* (Circa 27 BC), stated that buildings are to be designed to serve three major purposes: *firmitas*, *utilitas* and *venustas*. That is, buildings should be strong, useful and beautiful. This research focuses on *utilitas*, because as noted by Mawson (1994) designers tend to understand form (*venustas*), structures and systems (*firmitas*) rather than the pressures, behaviour and needs of the modern business (*utilitas*).

For a building to be *useful* it needs to support people’s behaviour to perform the required activity (Brill 1984): hospitals to heal, schools to teach and offices to work. If technology is changing how we heal, teach and work, architecture needs to change accordingly. Bechtel (1977) said “*behaviour, not space, is enclosed by architecture. No dwelling, building or city is planned to be empty*”.

It is thus, the evolution of the space required to support the transformation in the way people behave due to technology development that is of interest to this research.

Agustin Chevez Bernaldo de Quiros

RMIT University
CRC-Construction Innovation

2.1 Office evolution

As previously discussed technology affects various sectors of society, however this research focuses on workplace architecture (offices).

Giuliano (1985) states that “*new technology inevitably affects the organisation of work*” and identifies three stages of office organisation characterised not only by its technology but also by its style of management, personal policies, hierarchy of supervisory and managerial staff, standards of performance and human relations among the people involved in the office and their clients. Following are the three office models according to Giuliano: the pre-industrial, the industrial and the information age office.

The **Pre-industrial office**, Figure 1 (left), depends on the performance of the individuals, without much benefit from machines. There is little systematic organisation. Each person works independently, physically moving around to retrieve a file. Individuals have different styles of work and human relations are important. Loyalty, understanding, and mutual respect are cornerstones to the company. The only way to overcome an increase on the work load is by hiring more employees.

The **Industrial office**, Figure 1 (centre), is a response to the limitations of the Pre-industrial office and introduces the principles of work simplification, specialisation, and time-and-motion efficiency. It is essentially a production line. Work moves from desk to desk as parts move along an assembly line. Jobs are simple, repetitive and unsatisfying. The fragmentation of responsibility created bureaucracy and proliferation of paperwork. Workers do not know the overall task to which they are contributing. Errors are compounded but not fixed. Everyone has to work together during the same hours in the same office to sustain the flow of paper. Tasks are isolated and work performance measured in an attempt to maximize efficiency and output. Even personal interaction is standardised.

The **Information age office**, Figure 1 (right), combines systems and machines to the benefit of workers and clients, but tries to maintain the values of the pre-industrial office. It exploits new technology, yet it returns to people-centred work rather than machine-centred work. The machine is paced to the needs and abilities of the person who works with it. Instead of executing a small number of steps repetitively for a large number of accounts, one individual handles all customer-related records. Staff reduction of as much as 50% is common. Information is updated as it becomes available, and there is no uncertainties related to the ‘work in process’. Productivity is not longer measured by hours of work or number of items processed, but by customer satisfaction.

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 6/23

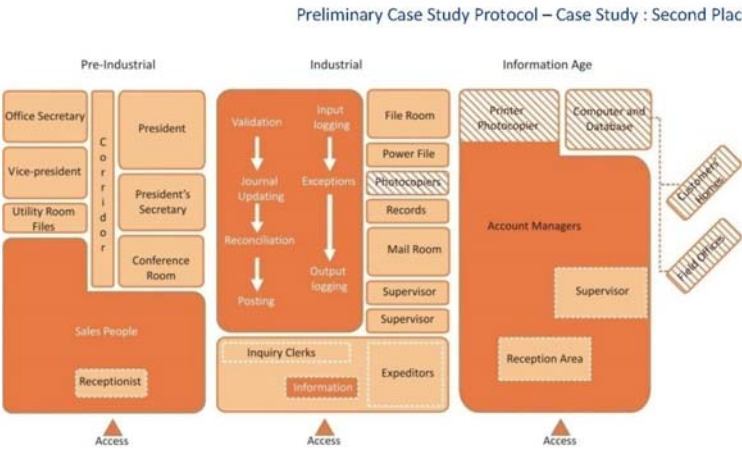


Figure 1. The Pre-Industrial, Industrial and Information Age Office, based on Giuliano (1985)

The rooms hatched on the Industrial and Information Age offices are rooms dedicated to host technology, or made possible only by communications technology (as in the case of the *Customers' Home* and *Field Offices* rooms of the Information Age office). Technology starts to claim physical space, but also blurs boundaries between geographic locations.

The Information age office as described above was Guilliano's vision in 1985, but as noted by the French poet Paul Valery "*The trouble with our times is that the future is not what it used to be*". Today's vision of the information age office is more radical. In fact there is no office, at least physically. Figure 2 shows a collage of images from *Second Places* environments, a UK company specialised in the development of collaboration environments based on Second Life.



Figure 2. Virtual environments hosted in Second Life, Second Places (2007)

2.2 Research objective

The objective of this research is to study *how* and to *what extent* changes in technology are changing workplace architecture. The two main research questions are:

- a) To what extent is information technology changing workplace architecture?
- b) How is information technology changing workplace architecture?

The word '*evolution*' in the research title was chosen to allude to the Darwinian natural selection process to which the different variants of workplace architecture (mutations) are submitted. The variants which perform better will prevail over the others and redefine workplace architecture.

3. SECOND PLACES CASE STUDY

The *Second Places* case study is of high interest to the research because it will help to better understand how cutting edge collaboration environments could affect the way we work. The findings of this case study will be compared with previous research efforts (see below) and analysed using Rogers' adoption of technology theory, refer to Figure 3, in order to forecast the probable impact of this technology in workplace architecture.

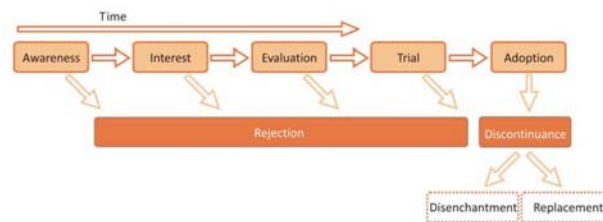


Figure 3. Rogers' adoption of technology theory (Rogers 1995)

3.1 Empirical data collection prior to *Second Places* Case Study

Two main data collection activities have taken place prior to the proposed *Second Places* case study.

Survey

In 2007, 105 companies in Melbourne and its suburbs participated in a survey designed to provide a cross section of the current workplace environment and working habits. Refer to Appendix CSB-D for a sample of the survey.

The results of this survey allowed to identify (amongst other things):

- Differences between working environments in the city and the suburbs;
- Differences between different types of work (accountants and designers);
- Differences between adapted spaces (e.g. former apartment unit currently used as an office) and purpose design offices;
- Level of technology adoption; and
- Level of adoption of Alternative Ways of Working (eg. Teleworking, hot-desking)

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Preliminary Case Study Protocol – Case Study : Second Places

Case Study (CS-A)

Following the survey, a more in-depth case study was undertaken. For one week, five participants of a selected company used a Work Sampling Diary (WSD) to register their working habits (refer to Appendix CSB-C). The study included analysis of the floor plan and individual working stations. Participants also completed the above-mentioned survey. Figure 4 is a screenshot of the technique used to analyse and present the results.

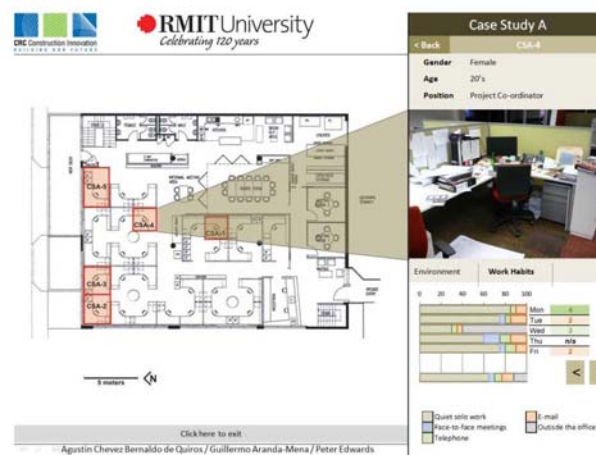


Figure 4. Case Study A – Analysis and presentation tool

3.2 Case Study Design

The proposed *Second Places* case study is divided in two parts:

- Second Places* Company (The service provider):** The first part of the case study will be to understand, and document, the concept behind *Second Places*, the collaboration services offered as well as their vision of the future of work collaboration. From the 11 services currently being offered by *Second Places*, **SP Collaborate** will be the focus of this study.
- Second Places* User (The client):** For this part of the case study a user (client) of **SP Collaborate** will be studied in a similar fashion as Case Study A (CS-A): the Work Sampling Diary and the Survey will be applied to the case study participants. Nevertheless, both research instruments will be modified for the particular characteristics of the selected company. It is requested that *Second Places* nominate the company to participate in this study using the attached nomination form. Refer to Appendix CSB-B.

3.3 Development of the Case Study Protocol

As previously mentioned, this document is a preliminary version of the Case Study Protocol. Based on the information collected by Appendix CSB-B (PDF form sent as an attachment: *SP-Questionnaire-Form.pdf*), the final research instruments will be developed.

Agustin Chevez Bernaldo de Quiros

RMIT University
CRC-Construction Innovation

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Preliminary Case Study Protocol – Case Study : Second Places

It is paramount for the success of this study that the information requested on the attached PDF-form is completed and returned no later than 11 of August in order to be able to follow the required sequence of activities shown in the following timeline. Refer to Figure 5.

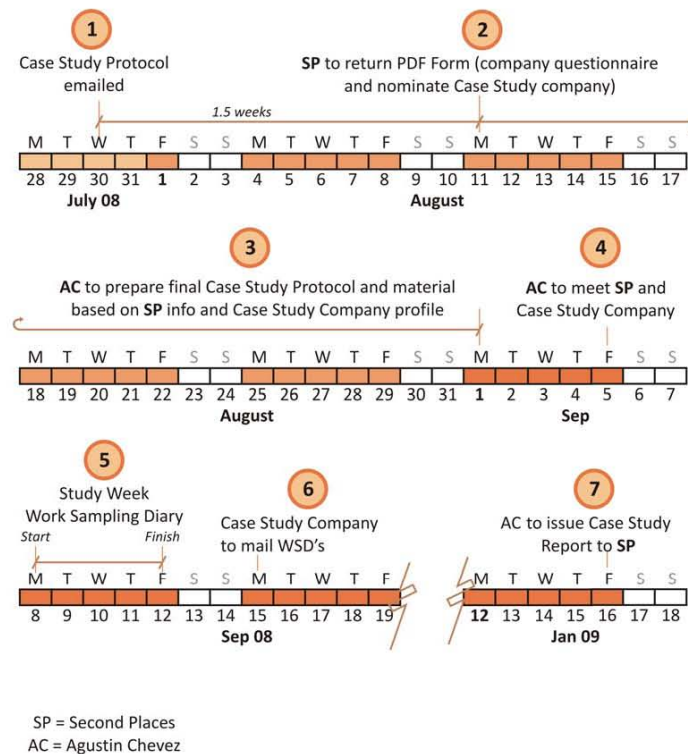


Figure 5. Case Study timeline

4. RMIT UNIVERSITY ETHICS

In order to ensure that participants are not exposed to physical, psychological and social risk above the everyday norm, this research complies with RMIT ethics guidelines. It is a requirement of RMIT Ethics department that all case study participants fill in and sign the attached RMIT Ethics form. Refer to Appendix CSB-A.

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 10/23**Appendix****CSB
A****RMIT Ethics consent form**

Please print, complete and sign form.

When finish please scan the form and email it with
Case Study Questionnaire (Appendix CSB-B)

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 11/23

RMIT HUMAN RESEARCH ETHICS COMMITTEE

Prescribed Consent form for persons participating in research projects involving tests administered to human subjects

PORTFOLIO OF
SCHOOL/CENTREDESIGN AND SOCIAL CONTEXT PORTAFOLIO
SCHOOL OF PROPERTY CONSTRUCTION AND PROJECT
MANAGEMENT

Name of participant:

Project Title:

Evolution of workplace architecture as a consequence of
technology development

Name(s) of investigators: (1)

Agustin Chevez

Phone:

0402 369 585

Name of participant:

Project Title: Evolution of workplace architecture as a consequence of technology development

1. I have received a statement explaining the tests involved in this project and I consent to participate in the above project.
2. I authorise the investigator or his or her assistant to use with me the tests: Questionnaire and Work Sampling Diary.
3. I acknowledge that:
 - (a) The possible effects of the tests have been explained to me to my satisfaction.
 - (b) I have been informed that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).
 - (c) The project is for the purpose of research and/or teaching. It may not be of direct benefit to me.
 - (d) The privacy of the information I provide will be safeguarded. However should information of a private nature need to be disclosed for moral, clinical or legal reasons, I will be given an opportunity to negotiate the terms of this disclosure.
 - (e) The security of the research data is assured during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to the Cooperative Research Centre for Construction Innovation (CRC-CI). Any information which will identify me will not be used.

Participant's Consent

Name:

Date:

(Participant)

Name:

Date:

(Witness to signature)

Where participant is under 18 years of age:

I consent to the participation of _____ in the above project.

Signature:

(1)

(2)

Date:

(Signatures of parents or guardians)

Name:

Date:

(Witness to signature)

Participants should be given a photocopy of this consent form after it has been signed.

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

Version #3: 7/24/2008

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Appendix

**CSB
B**

**Second Places Questionnaire and
Case Study Nomination Form**

**Please complete PDF form and submit it by:
Monday 11th of August 2008**

**[PDF Form sent as a separate attachment](#)
[Filename: SP-Questionnaire-Form.pdf](#)**

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 13/23

Case Study - Second Places

Please complete the following questionnaire. When finish press the 'email' button to email it.
Please also, save the completed form and email it to achbq@hotmail.com.

Thank you for your co-operation!

1 Company background (first established, number of employees, etc.)

Please type your comments here

2 What is the concept of Second Places?

Please type your answer here

3 Overview of services provided. Please provide more detail for *SP Collaborate*

Please type your comments here

4 How many clients use Second Places for work related collaboration purposes?

Please type your answer here

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 14/23

5

Is *SP Collaboration* the most popular service? If not, which one?

Please type your answer here

6

How is *SP Collaboration* commercialised? (Monthly payments, licence; indicative cost)

Please type your answer here

7

Who is your typical *SP Collaboration* client? (Profile: size, type of company, etc.)

Please type your answer here

8

Are there any special hardware/software requirements to run *SP Collaboration*?

Please type your answer here

9

Does Second Places provide training on how to use *SP Collaboration*?

Please type your answer here

2

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| | | |
|----|---|-------------------------------------|
| 10 | What are the benefits of <i>SP Collaboration</i> ? | <i>Please type your answer here</i> |
| 11 | How do you define 'work'? | <i>Please type your answer here</i> |
| 12 | Do you think that <i>Second Places</i> redefines the concept of work? | <i>Please type your answer here</i> |
| 13 | How would you describe the office of the future? | <i>Please type your answer here</i> |
| 14 | What are your views on the relationship between society and technology? | <i>Please type your answer here</i> |

3

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 16/23

Please feel free to add any comments.

Please type your comments here

Case Study - Company Nomination

Please nominate a company currently using **SP Collaboration** or any other of your services for work collaboration. The nominated company will be invited to participate in a one-week study set to understand their work environment and working habits.

Company name:

Contact name:

Contact email:

Brief company description: (Size, SP clients since, type [IT, accounting, design], etc)

Please type your comments here

4

Agustin Chevez Bernaldo de Quiros

A-49

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| | |
|---------------------------|----------|
| Appendix | CSB C |
| Work Sampling Diary (WSD) | |

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| |
|--|
| ID: |
| <small>The identification number on the questionnaire is for research purposes only. Your name and company will not be associated with the answers you give.</small> |

WORK SAMPLING DIARY

From: ^(Monday) 22 / OCT / 2007

To: ^(Sunday) 28 / OCT / 2007

Instructions

Please use this diary to provide information about your working habits. It is very important that you do this on a daily basis.

Note that:

- The information that you provide will not be disclosed to your employer.
- Your name will not be associated with the results.
- Information will be presented in an aggregated fashion.

The following 2 pages are examples on how to fill in your diary. The first example is for weekdays and the next one for the weekend (if applicable).

Please note that after the last day (Sunday) there is one more page for you to fill in. This page is very important because it helps to understand how representative is the information provided on this study week versus a typical week at work.

When finish, please insert your completed diary, together with your completed survey, into the provided envelope.

Thank you for your participation!

Please contact Agustin Chavez on s3032925@student.rmit.edu.au should you have any questions.

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 24702, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/about/rhrc

| MON DAY 1 | | SAT DAY 6 | |
|--|---------|---|---|
| Left home by: | 8:15 am | Arrived to work by: | 9:00 am |
| Had lunch from: | 1:00 pm | To: | 2:00 pm |
| <input checked="" type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | |
| Approximate percentage of time spent on: | | Comments: | |
| Quiet solo work | 15 % | Out of office for 2hrs - meeting with client. Today was a quiet day. Not too many phone calls. | |
| Face-to-face meetings | 10 % | | |
| Telephone | 10 % | | |
| E-mail | 30 % | | |
| Outside the office | 35 % | | |
| Working day | 100% | | |
| I could have done today's work from home or other place outside the office Disagree <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Agree | | | |
| Left work by: | 5:00 pm | Took work home | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |

| ONLY FILL THIS PAGE IF APPLICABLE | |
|--|---|
| Hours worked: | 2.5 hrs |
| From: | <input checked="" type="checkbox"/> Home <input type="checkbox"/> Office <input type="checkbox"/> Other |
| Approximate percentage of time spent on: | |
| Quiet solo work | 10 % |
| Face-to-face meetings | - % |
| Telephone | - % |
| E-mail | 30 % |
| Outside the office | - % |
| Working day | 100% |
| Comments: | |
| Reply to some outstanding e-mails. | |

If you did not work on the weekend please go to the last page. ➡

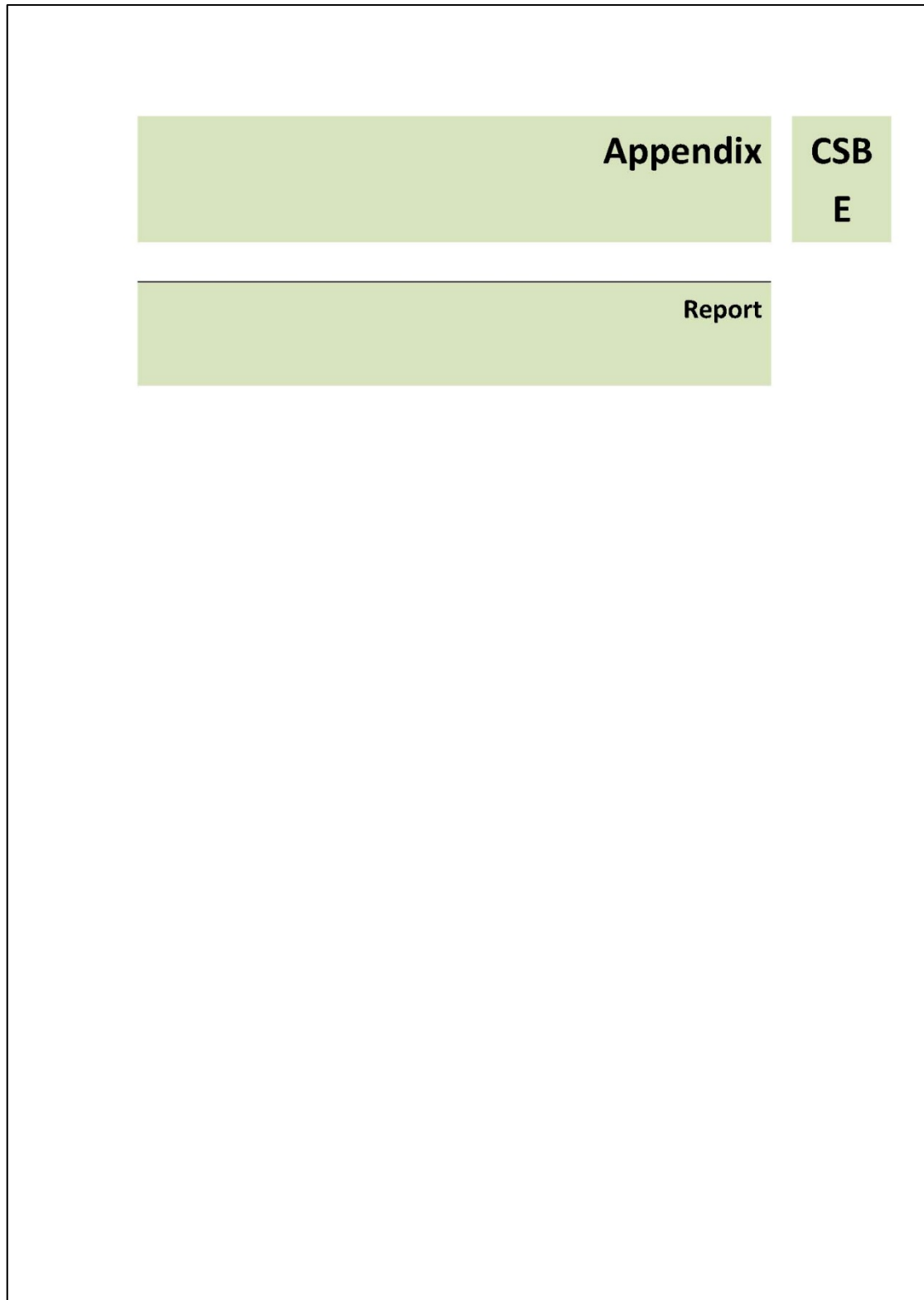
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| | |
|-----------------|------------------|
| Appendix | CSB D |
| Survey | |

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 20/23

| QUESTIONNAIRE | | ID: _____ |
|--|--|--|
| <p><i>Please tick the box if next to your preferred answer.</i></p> <p>Thank you for your co-operation!</p> | | <p>The identification number on the questionnaire is for monitoring and statistical purposes only. Your name and company will not be associated with the answers you give.</p> |
| 1 1 1 | | |
| 1 In what type of building is your office located? <input type="checkbox"/> Adapted home / apartment unit <input type="checkbox"/> Adapted warehouse or other non-office building <input type="checkbox"/> Office building or building designed for the organisation's activities | | |
| 2 Evaluate the following parameters at your workplace: | | |
| A) Temperature comfort | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| B) Ventilation comfort | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| C) Illumination comfort | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| D) Background noise level | Noisy <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Quiet | |
| E) Frequency of distractions | Frequent <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Rare | |
| F) Visual privacy at your workstation | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| G) Voice privacy at your workstation | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| H) General spatial arrangement | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| I) General furniture arrangement | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| J) General office size | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| K) General office storage space | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| L) Individual storage space | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| M) Work space available on workstation | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| N) Overall space environment satisfaction | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| 3 Which layout best describes your workplace? <input type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access <input type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations | | |
| 4 On average, you are at your desk / workstation: <div style="display: flex; justify-content: space-between; width: 100%;"> Rarely <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Most of the time <input type="checkbox"/> </div> | | |
| 5 Approximate percentage of time you spend in the following working modes: (Should add to 100%) <div style="display: flex; justify-content: space-between; width: 100%;"> <input type="checkbox"/> % Individual work, and quiet thinking <input type="checkbox"/> % Face-to-face collaboration <input type="checkbox"/> % Building relationships, and socialising </div> | | |
| 1 1 3 | | |
| 17 What type of computer do you have at work? <input type="checkbox"/> Desktop / non-portable <input type="checkbox"/> Laptop / portable <input type="checkbox"/> I do not have a computer | | |
| 18 Does your workplace have Internet connection? If Yes, please specify: <input type="checkbox"/> Dial-Up <input type="checkbox"/> Broadband <input type="checkbox"/> Wireless <input type="checkbox"/> No | | |
| 19 Does your company have a website? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 20 Is there a wireless network at your workplace? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 21 What type of monitors are used at your workplace? <input type="checkbox"/> Only CRT (non flat panel) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Only flat panel | | |
| 22 Which scenario best describes the adoption of new technology in your workplace? <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="checkbox"/> We adopt technology <u>after</u> everyone else in our field </div> <div style="width: 45%;"> <input type="checkbox"/> We adopt technology <u>before</u> the majority in our field </div> </div> | | |
| 23 Does your workplace rely more on faxes or e-mails to receive and send information? <input type="checkbox"/> E-mails <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Faxes | | |
| 24 Generally, non-spam e-mails, are: <input type="checkbox"/> Always printed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Never printed | | |
| 25 Are hardcopy documents scanned? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 26 Are there policies in your workplace to reduce the use of: | | |
| A) Electricity | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| B) Water | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| C) Paper | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| D) Use of cars | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| 27 Are desks / workstations shared in your office? (E.g. Hot-desking) <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 1 1 2 | | |
| 6 Which is the place where most productive work related interaction is done? <input type="checkbox"/> Meeting rooms <input type="checkbox"/> Each other's workstation / office <input type="checkbox"/> Informal environment within the office (Cafeteria / kitchen, etc) <input type="checkbox"/> Somewhere outside the office (Coffee shop, etc) | | |
| 7 How flexible is your workplace about when employees do their work? <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Employees must work within a specific time frame <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div style="width: 45%;"> Employees can choose when to work as long as they meet their targets <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div> | | |
| 8 How flexible is your workplace about where employees do their work? <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Work must be done at the office <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div style="width: 45%;"> Work may be done anywhere (home or other non-office environment) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div> | | |
| 9 How important is face-to-face interaction with workmates in daily activities? <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> No face-to-face interaction is required <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div style="width: 45%;"> Face to face interaction is essential in our daily activities <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div> | | |
| 10 Rank the level of bureaucracy at your workplace <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">Procedures are relaxed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div style="width: 45%;">Procedures must be strictly followed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 11 Rank the level of interpersonal-competitiveness at your workplace <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">Low <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div style="width: 45%;">High <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 12 How much do you depend on a computer for your daily work? <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> I do not need a computer to do my work <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div style="width: 45%;"> I could not do my work without a computer <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div> | | |
| 13 On average, how many hours do you work per week? <input type="text"/> Hrs / per week | | |
| 14 Do you take work home? <input type="checkbox"/> Never <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Everyday <input type="checkbox"/> I work from home (Teleworker) | | |
| 15 Do you work on weekends? <input type="checkbox"/> Never <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Every weekend | | |
| 16 Are you happy with your work / life balance? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 1 1 4 | | |
| 28 Which of the following you have at HOME? <i>Tick all that apply</i> <input type="checkbox"/> Computer <input type="checkbox"/> Printer <input type="checkbox"/> Fax <input type="checkbox"/> Dial-up / <input type="checkbox"/> Broadband / wireless Internet | | |
| 29 Is teleworking (working from home) an option at your workplace? If Yes, please specify: <input type="checkbox"/> I work from home <input type="text"/> days a week <input type="checkbox"/> I do not use this option, I rather go to the office | | |
| If No, please specify: <input type="checkbox"/> I would like to have the option of working from home <input type="checkbox"/> I rather go to the office | | |
| 30 Which do you think are the pros and cons of working from home? <i>Tick all that apply</i> | | |
| Pros <input type="checkbox"/> More free time <input type="checkbox"/> Increased productivity <input type="checkbox"/> Less commuting time <input type="checkbox"/> Freeing up of office space <input type="checkbox"/> More time with my family | Cons <input type="checkbox"/> Isolation <input type="checkbox"/> Longer working hours <input type="checkbox"/> Lack of motivation <input type="checkbox"/> Lack of a suitable environment at home <input type="checkbox"/> No boundaries between home and work | |
| 31 On average, how much time does it take to commute? (Return) <input type="text"/> Hrs <input type="text"/> Min | | |
| 32 On a typical day, which is your main way of transportation to get to work? <input type="checkbox"/> By foot / Bicycle <input type="checkbox"/> Public transport <input type="checkbox"/> Scooter / Motorcycle <input type="checkbox"/> Car | | |
| 33 How many people work at your company? (including yourself) <input type="checkbox"/> 1-10 <input type="checkbox"/> 11-20 <input type="checkbox"/> 21-40 <input type="checkbox"/> 41-60 <input type="checkbox"/> 61-99 <input type="checkbox"/> 100-150 <input type="checkbox"/> 151+ | | |
| 34 Your age group <input type="checkbox"/> 20's <input type="checkbox"/> 30's <input type="checkbox"/> 40's <input type="checkbox"/> 50's <input type="checkbox"/> 60's <input type="checkbox"/> 70's + | | |
| 35 Your gender <input type="checkbox"/> Male <input type="checkbox"/> Female | | |
| 36 Your position in the company: (e.g. director, manager, sales, production, secretarial, etc.) <input type="text"/> | | |
| Please insert the questionnaire into the provided pre-paid envelope and send it at your soonest convenience. | | THANK YOU! |

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 21/23



PRELIMINARY PROTOCOL-SECOND PLACES PAGE 22/23

Questionnaire ID: CSA-01

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|-------------------------------|-----------|--------------|----------------------|
| Type of Building..... | NR | | |
| Layout..... | Open-plan | | |
| Respondent's: Age..... | 50's | Gender.... | M |
| | | Position.... | Project Co-ordinator |
| Number of employees.... 21-40 | | | |

| Office Environment | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 3 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 3 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 2 | j) Office size..... | 4 |
| d) Noise comfort..... | 4 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 4 | l) Storage space..... | 4 |
| f) Visual privacy..... | 4 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 3 | n) Overall satisfaction..... | 4 |

| Type of work | % |
|--------------------------------|----|
| a) Individual Work..... | 80 |
| b) Face to Face..... | 15 |
| c) Building Relationships..... | 5 |

| Work / Life Balance | | | |
|-----------------------------|-----|------------------------|-------|
| Working hrs. Per week..... | 40 | Work on weekends | Never |
| Happy with W/L Balance..... | Yes | Take work home..... | Never |

| Technology at work | | | |
|----------------------------|------------------------|----------------------------|----------------|
| Adopter type..... | Innovator | Company has a website..... | Yes |
| Type of computer | Desktop / non-portable | Documents are scanned..... | No |
| Internet connection..... | Broadband | E-mails are..... | Mostly printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | E-mails only | | |
| Type of monitors used..... | Only Flat panel | | |

| Technology at home: | |
|--|--|
| Computer, Printer, Broadband / Wireless Connection | |

| Alternative Ways of Working (AWW) | | | |
|--------------------------------------|---|--|--|
| a) Time flexibility..... | 3 | | |
| b) Place flexibility..... | 2 | | |
| c) Face-to-face interaction (4)..... | 1 | | |
| d) Bureaucracy level (1)..... | 4 | | |
| e) Competitiveness (3)..... | 2 | | |
| f) Computer dependency..... | 4 | | |
| g) Workstation dependency (4)..... | 1 | | |
| Hot-desking implemented..... | No | | |
| Preferred interaction space..... | Each other's workstation / office | | |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. | | |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car | | |

| Perceived advantages of AWW | | Perceived disadvantages (AWW) | |
|---------------------------------|---|-------------------------------|---|
| More free time..... | | Isolation..... | |
| Increased productivity..... | | Longer working hrs..... | |
| Less commuting time..... | ✓ | Lack of motivation..... | |
| Freeing up of office space..... | ✓ | Lack of suitable environment | ✓ |
| More time with family..... | | No boundaries Home/Work..... | ✓ |

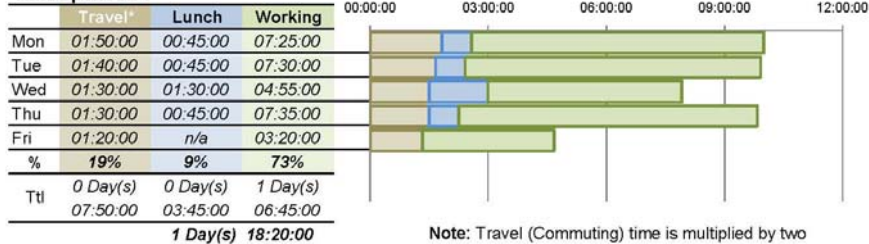
| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 40 min by Car |
| Office located in: | *Refer to Case Study description |

PRELIMINARY PROTOCOL-SECOND PLACES PAGE 23/23

Work Sampling Diary: CSA-01

WORK SAMPLING DIARY REPORT

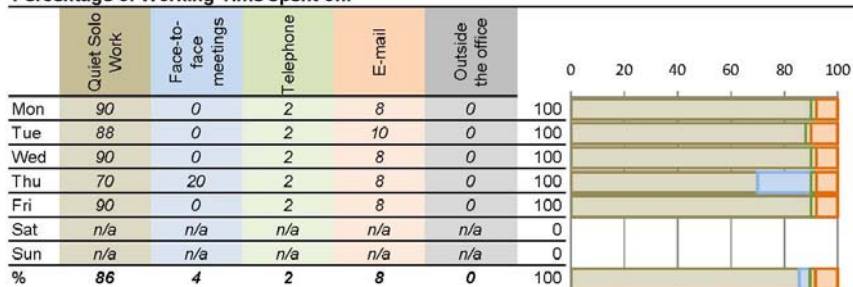
Time spent on :



Hours worked on weekend

Sat n/a
Sun n/a

Percentage of Working Time spent on:



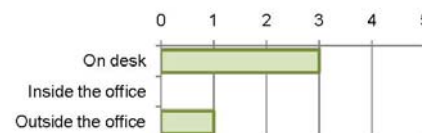
Could have done today's work from outside the office

Mon 1
Tue 1
Wed 1
Thu 1
Fri 1

Took work home

No
No
No
No
No

Number of times that had lunch



Week representativeness:

Quieter week than usual, however average time spent on tasks much the same.

Comments:

MON: Quiet day spent mainly on fine tuning outstanding projects | TUE: No comments | WED: Took 2 hours off in afternoon to carry out personal business | THU: No comments | FRI: Half day off left office at 12:00 Midday | SAT: n/a | SUN: n/a | OVERALL: No comments

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 1/22



Evolution of workplace architecture as a consequence of
technology development

Preliminary Case Study Protocol

Red C

August 2008

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 2/22

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Appendix CSB-A: RMIT Ethics Consent form

Appendix CSB-B: Red C Questionnaire (attachment)

Appendix CSB-C: Work Sampling Diary (WSD)-Example

Appendix CSB-D: Survey-Example

Appendix CSB-E: Reports

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 3/22

Preliminary Case Study Protocol – Case Study : Second Places / Red C

1. INTRODUCTION

Evolution of workplace architecture as a consequence of technology development is a PhD research currently undertaken by Agustin Chevez (the researcher) at RMIT University in Melbourne, Australia.

Following *Second Places* presentation at WorkTech in November 2007, the researcher engaged in a series of emails with the Director of the company to secure the opportunity to do a case study on *Second Places* and one of their clients in early September 2008.

Second Places nominated *Red C* as a potential case study. The purpose of this document is to familiarise *Red C* with the research and importance of this case study. Parallel, this document includes the case study timeline from end of July to the 5th of September (meeting in UK) and beyond (implementation of the case study). The most important outcome of this document will be the collection of information required from *Red C* to develop the final Case Study protocol.

The completion of this case study will mark the end of the empirical data collection of the research. The research will be finished by September 2009.

1.1 Research sponsor

This research is sponsored by the [Cooperative Research Centre for Construction Innovation](#) (CRC-CI)

1.2 Research supervisors

- **Academy** ([RMIT University](#))
 - Dr. Guillermo Aranda-Mena
 - Prof. Peter Edwards
- **Industry** ([Woods Bagot](#))
 - James Calder

1.3 Contact details

In case of any doubt regarding this document and the research in general please contact:

Researcher:

Agustin Chevez
achbq@hotmail.com

Research supervisor:

Dr. Guillermo Aranda-Mena
guillermo.aranda-mena@rmit.edu.au

Agustin Chevez Bernaldo de Quiros

RMIT University
CRC-Construction Innovation







1

Preliminary Case Study Protocol – Case Study : Second Places / Red C

2. BACKGROUND

The Information Technology Revolution is dramatically transforming the way most, if not all, sectors of society work, play, socialise together and undergo healing and recovery from illness. Almost every aspect of human endeavour is affected by technology change and with it the space requirements of those endeavours (Becker and Steele 1994; Castells 1996; Linturi 2000; Marmot and Eley 2000). Table 1 shows three strategic sectors of society: health, education and workplace in the early XX Century and in early XXI Century.

Table 1. Changes in health, education and workplace architecture

| | Health | Education | Workplace |
|-------------|---|---|---|
| XX Century |  <p>Operating room Luft, Potash et al. (2004)</p> |  <p>Traditional classroom Clayton (2005)</p> |  <p>Typists at a post office. Officemuseum.com (2005)</p> |
| XXI Century |  <p>Surgical Robot Butner and Ghodoussi (2003)</p> |  <p>Classroom Foote (2004)</p> |  <p>Workstations Knoll (2008)</p> |

From the above table it is clear that these spaces, as many others, have undergone a dramatic change in, both, their space requirements and the way we interact and behave in them. Vitruvius, in his treatise *De architectura* (Circa 27 BC), stated that buildings are to be designed to serve three major purposes: *firmitas*, *utilitas* and *venustas*. That is, buildings should be strong, useful and beautiful. This research focuses on *utilitas*, because as noted by Mawson (1994) designers tend to understand form (*venustas*), structures and systems (*firmitas*) rather than the pressures, behaviour and needs of the modern business (*utilitas*).

For a building to be *useful* it needs to support people's behaviour to perform the required activity (Brill 1984): hospitals to heal, schools to teach and offices to work. If technology is changing how we heal, teach and work, architecture needs to change accordingly. Bechtel (1977) said "*behaviour, not space, is enclosed by architecture. No dwelling, building or city is planned to be empty*".

It is thus, the evolution of the space required to support the transformation in the way people behave due to technology development that is of interest to this research.

Agustin Chevez Bernaldo de Quiros

RMIT University
CRC-Construction Innovation

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 5/22

Preliminary Case Study Protocol – Case Study : Second Places / Red C

2.1 Office evolution

As previously discussed technology affects various sectors of society, however this research focuses on workplace architecture (offices).

Giuliano (1985) states that *“new technology inevitably affects the organisation of work”* and identifies three stages of office organisation characterised not only by its technology but also by its style of management, personal policies, hierarchy of supervisory and managerial staff, standards of performance and human relations among the people involved in the office and their clients. Following are the three office models according to Giuliano: the pre-industrial, the industrial and the information age office.

The **Pre-industrial office**, Figure 1 (left), depends on the performance of the individuals, without much benefit from machines. There is little systematic organisation. Each person works independently, physically moving around to retrieve a file. Individuals have different styles of work and human relations are important. Loyalty, understanding, and mutual respect are cornerstones to the company. The only way to overcome an increase on the work load is by hiring more employees.

The **Industrial office**, Figure 1 (centre), is a response to the limitations of the Pre-industrial office and introduces the principles of work simplification, specialisation, and time-and-motion efficiency. It is essentially a production line. Work moves from desk to desk as parts move along an assembly line. Jobs are simple, repetitive and unsatisfying. The fragmentation of responsibility created bureaucracy and proliferation of paperwork. Workers do not know the overall task to which they are contributing. Errors are compounded but not fixed. Everyone has to work together during the same hours in the same office to sustain the flow of paper. Tasks are isolated and work performance measured in an attempt to maximize efficiency and output. Even personal interaction is standardised.

The **Information age office**, Figure 1 (right), combines systems and machines to the benefit of workers and clients, but tries to maintain the values of the pre-industrial office. It exploits new technology, yet it returns to people-centred work rather than machine-centred work. The machine is paced to the needs and abilities of the person who works with it. Instead of executing a small number of steps repetitively for a large number of accounts, one individual handles all customer-related records. Staff reduction of as much as 50% is common. Information is updated as it becomes available, and there is no uncertainties related to the ‘work in process’. Productivity is not longer measured by hours of work or number of items processed, but by customer satisfaction.

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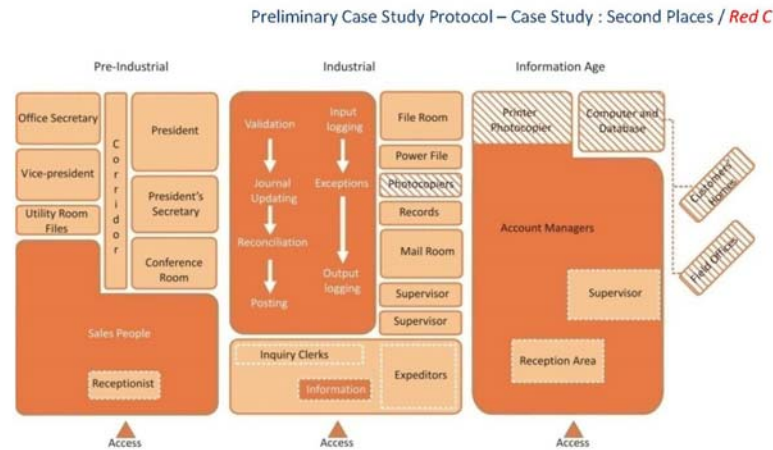


Figure 1. The Pre-Industrial, Industrial and Information Age Office, based on Giuliano (1985)

The rooms hatched on the Industrial and Information Age offices are rooms dedicated to host technology, or made possible only by communications technology (as in the case of the *Customers' Home* and *Field Offices* rooms of the Information Age office). Technology starts to claim physical space, but also blurs boundaries between geographic locations.

The Information age office as described above was Guillano's vision in 1985, but as noted by the French poet Paul Valery "*The trouble with our times is that the future is not what it used to be*". Today's vision of the information age office is more radical. In fact there is no office, at least physically. Figure 2 shows a collage of images from *Second Places* environments, a UK company specialised in the development of collaboration environments based on Second Life.



Figure 2. Virtual environments hosted in Second Life, Second Places (2007)

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Preliminary Case Study Protocol – Case Study : Second Places / Red C

2.2 Research objective

The objective of this research is to study *how* and to *what extent* changes in technology are changing workplace architecture. The two main research questions are:

- a) To what extent is information technology changing workplace architecture?
- b) How is information technology changing workplace architecture?

The word '*evolution*' in the research title was chosen to allude to the Darwinian natural selection process to which the different variants of workplace architecture (mutations) are submitted. The variants which perform better will prevail over the others and redefine workplace architecture.

3. SECOND PLACES CASE STUDY

The *Second Places / Red C* case study is of high interest to the research because it will help to better understand how cutting edge collaboration environments could affect the way we work. The findings of this case study will be compared with previous research efforts (see below) and analysed using Rogers' adoption of technology theory, refer to Figure 3, in order to forecast the probable impact of this technology in workplace architecture.

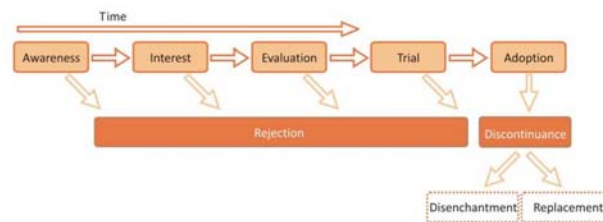


Figure 3. Rogers' adoption of technology theory (Rogers 1995)

3.1 Empirical data collection prior to *Second Places / Red C* Case Study

Two main data collection activities have taken place prior to the proposed *Second Places / Red C* case study.

Survey

In 2007, 105 companies in Melbourne and its suburbs participated in a survey designed to provide a cross section of the current workplace environment and working habits. Refer to Appendix CSB-D for a sample of the survey.

The results of this survey allowed to identify (amongst other things):

- Differences between working environments in the city and the suburbs;
- Differences between different types of work (accountants and designers);
- Differences between adapted spaces (e.g. former apartment unit currently used as an office) and purpose design offices;
- Level of technology adoption; and
- Level of adoption of Alternative Ways of Working (eg. Teleworking, hot-desking)

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Preliminary Case Study Protocol – Case Study : Second Places / Red C

Case Study (CS-A)

Following the survey, a more in-depth case study was undertaken. For one week, five participants of a selected company used a Work Sampling Diary (WSD) to register their working habits (refer to Appendix CSB-C). The study included analysis of the floor plan and individual working stations. Participants also completed the above-mentioned survey. Figure 4 is a screenshot of the technique used to analyse and present the results.

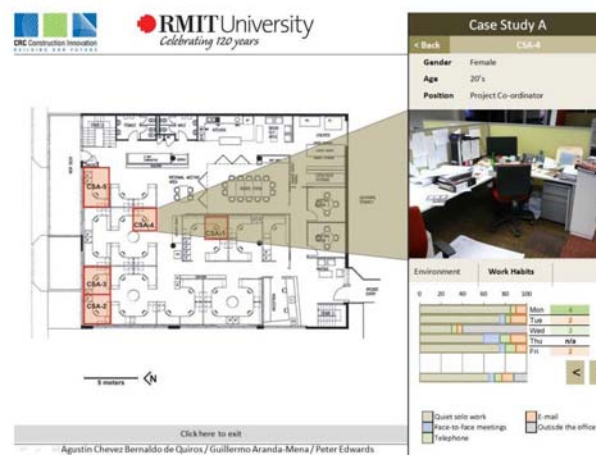


Figure 4. Case Study A – Analysis and presentation tool

3.2 Case Study Design

The proposed *Second Places / Red C* case study is divided in two parts:

- a) **Second Places (The service provider):** The first part of the case study will be to understand, and document, the concept behind *Second Places*, the collaboration services offered as well as their vision of the future of work collaboration. From the 11 services currently being offered by *Second Places*, *SP Collaborate* will be the focus of this study.
- b) **Red C (The client):** For this part of the case study, *Red C* will be studied in a similar fashion as Case Study A (CS-A): the Work Sampling Diary and the Survey (refer to samples) will be applied to 5 staff members (selected by *Red C*). In order to do the analysis to the same extent as CS-A the following is required from *Red C*:
 - a. **Floor plan:** a copy of the architectural floor plan (see figure 4).
 - b. **Workstation pictures:** A picture of each of the case study participants' workstation (without people – RMIT Ethics). Refer to example (Appendix E)
 - c. **Shared spaces pictures:** A couple of general office shots.
 - d. **Screen shots of *Second Places* applications:** A couple of screen shots of *SP* application with a short description.
 - e. **Completed Survey:** Refer to Appendix CSB-D.
 - f. **Completed WSD:** Refer to Appendix CSB-C.

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Preliminary Case Study Protocol – Case Study : Second Places / Red C

3.3 Development of the Case Study Protocol

As previously mentioned, this document is a preliminary version of the Case Study Protocol. Based on the information collected by Appendix CSB-B (PDF form sent as an attachment: RedC-Questionnaire-Form.pdf), the final research instruments will be developed.

It is paramount for the success of this study that the information requested on the attached PDF-form is completed and returned no later than 27 of August in order to be able to follow the required sequence of activities shown in the following timeline. Refer to Figure 5.

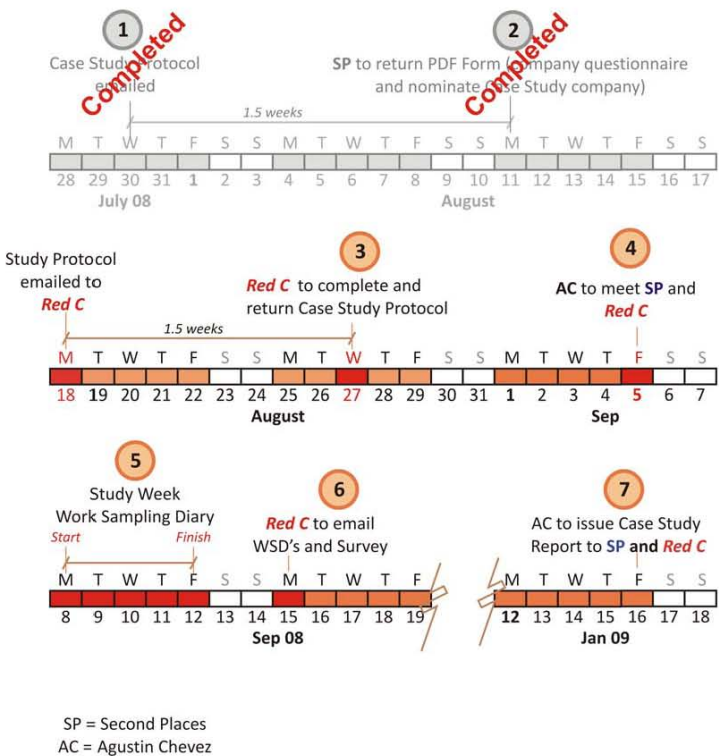


Figure 5. Case Study timeline

4. RMIT UNIVERSITY ETHICS

In order to ensure that participants are not exposed to physical, psychological and social risk above the everyday norm, this research complies with RMIT ethics guidelines. It is a requirement of RMIT Ethics department that all case study participants fill in and sign the attached RMIT Ethics form. Refer to Appendix CSB-A.

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Appendix

**CSB
A**

RMIT Ethics consent form

Please print, complete and sign form.

When finish please scan the form and email it with
Case Study Questionnaire (Appendix CSB-B)

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RMIT HUMAN RESEARCH ETHICS COMMITTEE

Prescribed Consent form for persons participating in research projects involving tests administered to human subjects

PORTFOLIO OF
SCHOOL/CENTREDESIGN AND SOCIAL CONTEXT PORTAFOLIO
SCHOOL OF PROPERTY CONSTRUCTION AND PROJECT
MANAGEMENT

Name of participant:

Project Title:

Evolution of workplace architecture as a consequence of
technology development

Name(s) of investigators: (1)

Agustin Chevez

Phone:

0402 369 585

Name of participant:

Project Title: Evolution of workplace architecture as a consequence of technology development

1. I have received a statement explaining the tests involved in this project and I consent to participate in the above project.
2. I authorise the investigator or his or her assistant to use with me the tests: Questionnaire and Work Sampling Diary.
3. I acknowledge that:
 - (a) The possible effects of the tests have been explained to me to my satisfaction.
 - (b) I have been informed that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).
 - (c) The project is for the purpose of research and/or teaching. It may not be of direct benefit to me.
 - (d) The privacy of the information I provide will be safeguarded. However should information of a private nature need to be disclosed for moral, clinical or legal reasons, I will be given an opportunity to negotiate the terms of this disclosure.
 - (e) The security of the research data is assured during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to the Cooperative Research Centre for Construction Innovation (CRC-CI). Any information which will identify me will not be used.

Participant's Consent

Name:

Date:

(Participant)

Name:

Date:

(Witness to signature)

Where participant is under 18 years of age:

I consent to the participation of _____ in the above project.

Signature:

(1)

(2)

Date:

(Signatures of parents or guardians)

Name:

Date:

(Witness to signature)

Participants should be given a photocopy of this consent form after it has been signed.

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

Version #3: 7/24/2008

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Appendix

**CSB
B**

Red C Questionnaire

**Please complete PDF form and submit it by:
Wednesday 27th of August 2008**

[PDF Form sent as a separate attachment](#)

[Filename: RedC-Questionnaire-Form.pdf](#)

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 13/22**Case Study - Red C**

*Please complete the following questionnaire. When finish press the 'email' button to email it.
Please also, save the completed form and email it to achbq@hotmail.com.
Thank you for your co-operation!*

1 **Company background** (first established, number of employees, etc.)

Please type your answer here

2 **Why did you contact Second Places?**

Please type your answer here

3 **Please comment on the virtual world presence developed for one of your clients by Second Places.**

Please type your answer here

4 **Please comment on your in-world office presence developed by Second Places?**

Please type your answer here

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| | | |
|---|---|-------------------------------------|
| 5 | What are the benefits (if any) of virtual worlds? | <i>Please type your answer here</i> |
| 6 | How do you define 'work'? | <i>Please type your answer here</i> |
| 7 | Do you think that <i>Second Places</i> redefine the concept of work? | <i>Please type your answer here</i> |
| 8 | How would you describe the office of the future? | <i>Please type your answer here</i> |
| 9 | What are your views on the relationship between society and technology? | <i>Please type your answer here</i> |

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| | | |
|---------------------------|--|-----|
| Appendix | | CSB |
| | | C |
| Work Sampling Diary (WSD) | | |

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| |
|--|
| ID: |
| <small>The identification number on the questionnaire is for research purposes only. Your name and company will not be associated with the answers you give.</small> |

WORK SAMPLING DIARY

From: ^(Monday) 22 / OCT / 2007

To: ^(Sunday) 28 / OCT / 2007

Instructions

Please use this diary to provide information about your working habits. It is very important that you do this on a daily basis.

Note that:

- The information that you provide will not be disclosed to your employer.
- Your name will not be associated with the results.
- Information will be presented in an aggregated fashion.

The following 2 pages are examples on how to fill in your diary. The first example is for weekdays and the next one for the weekend (if applicable).

Please note that after the last day (Sunday) there is one more page for you to fill in. This page is very important because it helps to understand how representative is the information provided on this study week versus a typical week at work.

When finish, please insert your completed diary, together with your completed survey, into the provided envelope.

Thank you for your participation!

Please contact Agustin Chavez on s3032925@student.rmit.edu.au should you have any questions.

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 24762, Melbourne, 3001. The telephone number is (03) 9925 1745. Details of the complaints procedure are available from: www.rmit.edu.au/about/rhrc

| MON DAY 1 | | SAT DAY 6 | |
|--|---------|---|---|
| Left home by: | 8:15 am | Arrived to work by: | 9:00 am |
| Had lunch from: | 1:00 pm | To: | 2:00 pm |
| <input checked="" type="checkbox"/> On my desk <input type="checkbox"/> Somewhere inside the office <input type="checkbox"/> Outside the office | | | |
| Approximate percentage of time spent on: | | Comments: | |
| Quiet solo work | 15 % | Out of office for 2hrs - meeting with client. Today was a quiet day. Not too many phone calls. | |
| Face-to-face meetings | 10 % | | |
| Telephone | 10 % | | |
| E-mail | 30 % | | |
| Outside the office | 35 % | | |
| Working day | 100% | | |
| I could have done today's work from home or other place outside the office Disagree <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Agree | | | |
| Left work by: | 5:00 pm | Took work home | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |

| ONLY FILL THIS PAGE IF APPLICABLE | |
|--|---|
| Hours worked: | 2.5 hrs |
| From: | <input checked="" type="checkbox"/> Home <input type="checkbox"/> Office <input type="checkbox"/> Other |
| Approximate percentage of time spent on: | |
| Quiet solo work | 10 % |
| Face-to-face meetings | - % |
| Telephone | - % |
| E-mail | 30 % |
| Outside the office | - % |
| Working day | 100% |
| Comments: | |
| Reply to some outstanding e-mails. | |

If you did not work on the weekend please go to the last page. ➡

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| | |
|----------|----------|
| Appendix | CSB D |
| Survey | |

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| QUESTIONNAIRE | | ID: _____ |
|--|--|--|
| <p><i>Please tick the box if next to your preferred answer.</i></p> <p>Thank you for your co-operation!</p> | | <p>The identification number on the questionnaire is for monitoring and statistical purposes only. Your name and company will not be associated with the answers you give.</p> |
| 1 1 1 | | |
| 1 In what type of building is your office located? <input type="checkbox"/> Adapted home / apartment unit <input type="checkbox"/> Adapted warehouse or other non-office building <input type="checkbox"/> Office building or building designed for the organisation's activities | | |
| 2 Evaluate the following parameters at your workplace: | | |
| A) Temperature comfort | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| B) Ventilation comfort | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| C) Illumination comfort | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| D) Background noise level | Noisy <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Quiet | |
| E) Frequency of distractions | Frequent <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Rare | |
| F) Visual privacy at your workstation | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| G) Voice privacy at your workstation | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| H) General spatial arrangement | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| I) General furniture arrangement | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| J) General office size | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| K) General office storage space | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| L) Individual storage space | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| M) Work space available on workstation | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| N) Overall space environment satisfaction | Poor <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Good | |
| 3 Which layout best describes your workplace? <input type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access <input type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations | | |
| 4 On average, you are at your desk / workstation: <div style="display: flex; justify-content: space-between; width: 100%;"> Rarely <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Most of the time <input type="checkbox"/> </div> | | |
| 5 Approximate percentage of time you spend in the following working modes: (Should add to 100%) <div style="display: flex; justify-content: space-between; width: 100%;"> <input type="checkbox"/> % Individual work, and quiet thinking <input type="checkbox"/> % Face-to-face collaboration <input type="checkbox"/> % Building relationships, and socialising </div> | | |
| 1 1 3 | | |
| 17 What type of computer do you have at work? <input type="checkbox"/> Desktop / non-portable <input type="checkbox"/> Laptop / portable <input type="checkbox"/> I do not have a computer | | |
| 18 Does your workplace have Internet connection? If Yes, please specify: <input type="checkbox"/> Dial-Up <input type="checkbox"/> Broadband <input type="checkbox"/> Wireless <input type="checkbox"/> No | | |
| 19 Does your company have a website? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 20 Is there a wireless network at your workplace? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 21 What type of monitors are used at your workplace? <input type="checkbox"/> Only CRT (non flat panel) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Only flat panel | | |
| 22 Which scenario best describes the adoption of new technology in your workplace? <div style="display: flex; justify-content: space-between;"> <div> We adopt technology <u>after</u> everyone else in our field. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div> We adopt technology <u>before</u> the majority in our field. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> </div> | | |
| 23 Does your workplace rely more on faxes or e-mails to receive and send information? <div style="display: flex; justify-content: space-between; width: 100%;"> E-mails <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Faxes <input type="checkbox"/> </div> | | |
| 24 Generally, non-spam e-mails, are: <div style="display: flex; justify-content: space-between; width: 100%;"> Always printed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Never printed <input type="checkbox"/> </div> | | |
| 25 Are hardcopy documents scanned? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 26 Are there policies in your workplace to reduce the use of: | | |
| A) Electricity | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| B) Water | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| C) Paper | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| D) Use of cars | <input type="checkbox"/> Yes <input type="checkbox"/> Yes, but not properly followed <input type="checkbox"/> No | |
| 27 Are desks / workstations shared in your office? (E.g. Hot-desking) <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 1 1 2 | | |
| 6 Which is the place where most productive work related interaction is done? <input type="checkbox"/> Meeting rooms <input type="checkbox"/> Each other's workstation / office <input type="checkbox"/> Informal environment within the office (Cafeteria / kitchen, etc) <input type="checkbox"/> Somewhere outside the office (Coffee shop, etc) | | |
| 7 How flexible is your workplace about when employees do their work? <div style="display: flex; justify-content: space-between; width: 100%;"> <div>Employees must work within a specific time frame <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>Employees can choose when to work as long as they meet their targets <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 8 How flexible is your workplace about where employees do their work? <div style="display: flex; justify-content: space-between; width: 100%;"> <div>Work must be done at the office <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>Work may be done anywhere (home or other non-office environment) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 9 How important is face-to-face interaction with workmates in daily activities? <div style="display: flex; justify-content: space-between; width: 100%;"> <div>No face-to-face interaction is required <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>Face to face interaction is essential in our daily activities <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 10 Rank the level of bureaucracy at your workplace <div style="display: flex; justify-content: space-between; width: 100%;"> <div>Procedures are relaxed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>Procedures must be strictly followed <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 11 Rank the level of interpersonal competitiveness at your workplace <div style="display: flex; justify-content: space-between; width: 100%;"> <div>Low <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>High <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 12 How much do you depend on a computer for your daily work? <div style="display: flex; justify-content: space-between; width: 100%;"> <div>I do not need a computer to do my work <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>I could not do my work without a computer <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 13 On average, how many hours do you work per week? <input type="text"/> Hrs / per week | | |
| 14 Do you take work home? <div style="display: flex; justify-content: space-between; width: 100%;"> <div>Never <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>Everyday <input type="checkbox"/></div> <div>I work from home (Teleworker) <input type="checkbox"/></div> </div> | | |
| 15 Do you work on weekends? <div style="display: flex; justify-content: space-between; width: 100%;"> <div>Never <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> <div>Every weekend <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></div> </div> | | |
| 16 Are you happy with your work / life balance? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| 1 1 4 | | |
| 28 Which of the following you have at HOME? <i>Tick all that apply</i> <input type="checkbox"/> Computer <input type="checkbox"/> Printer <input type="checkbox"/> Fax <input type="checkbox"/> Dial-up / <input type="checkbox"/> Broadband / wireless Internet | | |
| 29 Is teleworking (working from home) an option at your workplace? <div style="display: flex; justify-content: space-between;"> <div> If Yes, please specify: <input type="checkbox"/> I work from home <input type="text"/> days a week <input type="checkbox"/> I do not use this option, I rather go to the office </div> <div> If No, please specify: <input type="checkbox"/> I would like to have the option of working from home <input type="checkbox"/> I rather go to the office </div> </div> | | |
| 30 Which do you think are the pros and cons of working from home? <i>Tick all that apply</i> | | |
| Pros <input type="checkbox"/> More free time <input type="checkbox"/> Increased productivity <input type="checkbox"/> Less commuting time <input type="checkbox"/> Freeing up of office space <input type="checkbox"/> More time with my family | Cons <input type="checkbox"/> Isolation <input type="checkbox"/> Longer working hours <input type="checkbox"/> Lack of motivation <input type="checkbox"/> Lack of a suitable environment at home <input type="checkbox"/> No boundaries between home and work | |
| 31 On average, how much time does it take to commute? (Return) <input type="text"/> Hrs <input type="text"/> Min | | |
| 32 On a typical day, which is your main way of transportation to get to work? <input type="checkbox"/> By foot / Bicycle <input type="checkbox"/> Public transport <input type="checkbox"/> Scooter / Motorcycle <input type="checkbox"/> Car | | |
| 33 How many people work at your company? (including yourself) <input type="checkbox"/> 1-10 <input type="checkbox"/> 11-20 <input type="checkbox"/> 21-40 <input type="checkbox"/> 41-60 <input type="checkbox"/> 61-99 <input type="checkbox"/> 100-150 <input type="checkbox"/> 151+ | | |
| 34 Your age group <input type="checkbox"/> 20's <input type="checkbox"/> 30's <input type="checkbox"/> 40's <input type="checkbox"/> 50's <input type="checkbox"/> 60's <input type="checkbox"/> 70's + | | |
| 35 Your gender <input type="checkbox"/> Male <input type="checkbox"/> Female | | |
| 36 Your position in the company: (e.g. director, manager, sales, production, secretarial, etc.) <input type="text"/> | | |
| Please insert the questionnaire into the provided pre-paid envelope and send it at your soonest convenience. | | THANK YOU! |

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| | | |
|----------|--|----------|
| Appendix | | CSB E |
| Report | | |

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Questionnaire ID: CSA-01

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|-------------------------------|-----------|--------------|----------------------|
| Type of Building..... | NR | | |
| Layout..... | Open-plan | | |
| Respondent's: Age..... | 50's | Gender.... | M |
| | | Position.... | Project Co-ordinator |
| Number of employees.... 21-40 | | | |

| Office Environment | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 3 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 3 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 2 | j) Office size..... | 4 |
| d) Noise comfort..... | 4 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 4 | l) Storage space..... | 4 |
| f) Visual privacy..... | 4 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 3 | n) Overall satisfaction..... | 4 |

| Type of work | % |
|--------------------------------|----|
| a) Individual Work..... | 80 |
| b) Face to Face..... | 15 |
| c) Building Relationships..... | 5 |

| Work / Life Balance | | | |
|-----------------------------|-----|-----------------------|-------|
| Working hrs. Per week..... | 40 | Work on weekends..... | Never |
| Happy with W/L Balance..... | Yes | Take work home..... | Never |

| Technology at work | | | |
|----------------------------|------------------------|----------------------------|----------------|
| Adopter type..... | Innovator | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | No |
| Internet connection..... | Broadband | E-mails are..... | Mostly printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | E-mails only | | |
| Type of monitors used..... | Only Flat panel | | |

| Technology at home: | |
|--|--|
| Computer, Printer, Broadband / Wireless Connection | |

| Alternative Ways of Working (AWW) | | | |
|--------------------------------------|---|--|--|
| a) Time flexibility..... | 3 | | |
| b) Place flexibility..... | 2 | | |
| c) Face-to-face interaction (4)..... | 1 | | |
| d) Bureaucracy level (1)..... | 4 | | |
| e) Competitiveness (3)..... | 2 | | |
| f) Computer dependency..... | 4 | | |
| g) Workstation dependency (4)..... | 1 | | |
| Hot-desking implemented..... | No | | |
| Preferred interaction space..... | Each other's workstation / office | | |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. | | |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car | | |

| Perceived advantages of AWW | | Perceived disadvantages (AWW) | |
|---------------------------------|---|-----------------------------------|---|
| More free time..... | | Isolation..... | |
| Increased productivity..... | | Longer working hrs..... | |
| Less commuting time..... | ✓ | Lack of motivation..... | |
| Freeing up of office space..... | ✓ | Lack of suitable environment..... | ✓ |
| More time with family..... | | No boundaries Home/Work..... | ✓ |

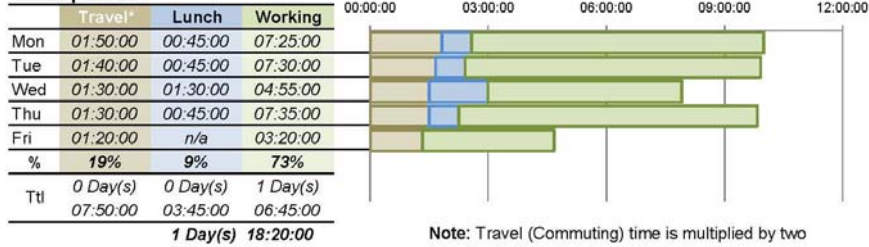
| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 40 min by Car |
| Office located in: | *Refer to Case Study description |

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 21/22

Work Sampling Diary: CSA-01

WORK SAMPLING DIARY REPORT

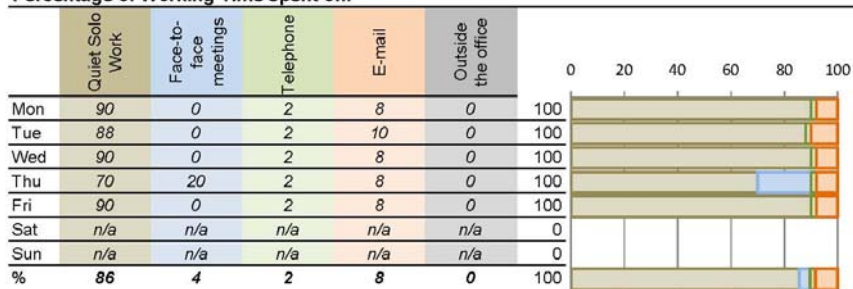
Time spent on :



Hours worked on weekend

Sat n/a
Sun n/a

Percentage of Working Time spent on:



Could have done today's work from outside the office

Mon 1
Tue 1
Wed 1
Thu 1
Fri 1

Took work home

No
No
No
No
No

Number of times that had lunch



Week representativeness:

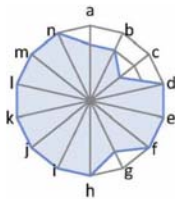

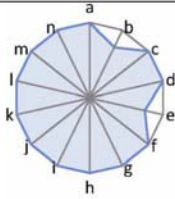

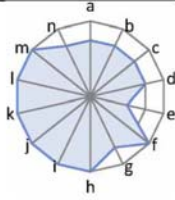

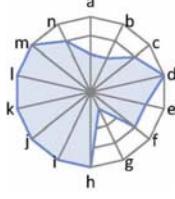

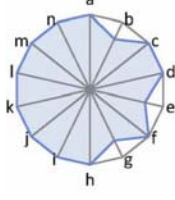

Quieter week than usual, however average time spent on tasks much the same.

Comments:

MON: Quiet day spent mainly on fine tuning outstanding projects | TUE: No comments | WED: Took 2 hours off in afternoon to carry out personal business | THU: No comments | FRI: Half day off left office at 12:00 Midday | SAT: n/a | SUN: n/a | OVERALL: No comments

PRELIMINARY PROTOCOL-NOMINATED COMPANY PAGE 22/22

Table 8.2. Office environment parameters and participants' workstation

| | | |
|-------|---|--|
| CSA-1 |  |  |
| CSA-2 |  |  |
| CSA-3 |  |  |
| CSA-4 |  |  |
| CSA-5 |  |  |

Key to Chart: a) Temperature comfort, b) Ventilation comfort, c) Illumination comfort, d) Noise comfort, e) Frequency of distractions, f) Visual privacy, g) Voice privacy, h) Spatial arrangement, i) Furniture arrangement, j) Office size, k) Office storage, l) Storage space, m) Space on work station, n) Overall satisfaction.

Agustin Chevez Bernaldo de Quiros



INSTRUCTIONS-NOMINATED COMPANY

Instructions

- Select six **RED C** staff members to participate in the study. Selection should be done based on:
 - **3 PC users** (Account teams), of which one of them teleworks (e.g. works from home) at least one day a week.
 - **3 Mac users** (Design teams), of which one of them teleworks (e.g. works from home) at least one day a week.
- Forward the following attached PDF forms to the selected participants:
 - **Questionnaire** (Survey-Form.pdf) and;
 - **Work Sampling Diary** (WSD-Form.pdf)
- Both PDF forms are to be completed for the **current offices** and for the **new offices**. Participants that complete the survey and WSD for the current office must be the same as for the new office (grouped by colour, refer to table).
- Participants shall rename the PDF forms as per the following table and save them with their input.

| Stage | Start date | PC users | Mac users |
|-----------------|---|----------------|-----------------|
| Current offices | 15/SEP/08 Or 22/SEP/08 | CSB-PC-S1-O-C | CSB-Mac-S1-O-C |
| | | CSB-PC-D1-O-C | CSB-Mac-D1-O-C |
| | | CSB-PC-S2-O-C | CSB-Mac-S2-O-C |
| | | CSB-PC-D2-O-C | CSB-Mac-D2-O-C |
| | | CSB-PC-S3-TW-C | CSB-Mac-S3-TW-C |
| | | CSB-PC-D3-TW-C | CSB-Mac-D3-TW-C |
| New offices | 1 month after moving into the new offices | CSB-PC-S1-O-N | CSB-Mac-S1-O-N |
| | | CSB-PC-D1-O-N | CSB-Mac-D1-O-N |
| | | CSB-PC-S2-O-N | CSB-Mac-S2-O-N |
| | | CSB-PC-D2-O-N | CSB-Mac-D2-O-N |
| | | CSB-PC-S3-TW-N | CSB-Mac-S3-TW-N |
| | | CSB-PC-D3-TW-N | CSB-Mac-D3-TW-N |

File names are based on the following syntax:

CSB – Case Study B

PC/MAC – PC (Account) or Mac (Design) user

S/D – Survey (Questionnaire) / Diary (WSD)

1 to 3 – Participant's number

O/TW – Office (participant always works at the office) / Teleworker (Participant works at least one day a week remotely. E.g. Home)

C/N – Current office / New office

Appendix 6d

Research Background Case Study CS-C Interview agenda

RESEARCH BACKGROUND PAGE 1/6

Evolution of workplace architecture as a consequence of technology development

Research background

INTRODUCTION

Evolution of workplace architecture as a consequence of technology development is a PhD research currently undertaken by Agustin Chevez (the researcher) at RMIT University in Melbourne, Australia.

The research is expected to be finished by early 2009.

Research sponsor

This research is sponsored by the [Cooperative Research Centre for Construction Innovation](#) (CRC-CI)

Research supervisors

- **Academy** ([RMIT University](#))
 - Dr. Guillermo Aranda-Mena
 - Prof. Peter Edwards
- **Industry** ([Woods Bagot](#))
 - James Calder

Contact details

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RESEARCH BACKGROUND PAGE 2/6

Evolution of workplace architecture as a consequence of technology development

RESEARCH BACKGROUND

The Information Technology Revolution is dramatically transforming the way most, if not all, sectors of society work, play, socialise together and undergo healing and recovery from illness (Becker and Steele 1994; Castells 1996; Linturi 2000; Marmot and Eley 2000). Table 1 shows three strategic sectors of society: health, education and workplace in the early XX Century and in early XXI Century.

Table 1. Changes in health, education and workplace architecture

| | Health | Education | Workplace |
|-------------|---|---|---|
| XX Century |  <p>Operating room Luft, Potash et al. (2004)</p> |  <p>Traditional classroom Clayton (2005)</p> |  <p>Typists at a post office. Officemuseum.com (2005)</p> |
| XXI Century |  <p>Surgical Robot Butner and Ghodoussi (2003)</p> |  <p>Classroom Foote (2004)</p> |  <p>Workstations Knoll (2008)</p> |

From the above table it is clear that these spaces, as many others, have undergone a change in, both, their space requirements and the way we interact and behave in them. Vitruvius, in his treatise *De architectura* (Circa 27 BC), stated that buildings are to be designed to serve three major purposes: *firmitas*, *utilitas* and *venustas*. That is, buildings should be strong, useful and beautiful. This research focuses on *utilitas*, because as noted by Mawson (1994) designers tend to understand form (*venustas*), structures and systems (*firmitas*) rather than the pressures, behaviour and needs of the modern business (*utilitas*).

For a building to be *useful* it needs to support people's behaviour to perform the required activity (Brill 1984): hospitals to heal, schools to teach and offices to work. If technology is changing how we heal, teach and work, architecture needs to change accordingly. Bechtel (1977) said "*behaviour, not space, is enclosed by architecture. No dwelling, building or city is planned to be empty*".

It is thus, the evolution of the space required to support the transformation in the way people behave due to technology development that is of interest to this research.

RESEARCH BACKGROUND PAGE 3/6

Evolution of workplace architecture as a consequence of technology development

OFFICE EVOLUTION

As previously discussed technology affects various sectors of society, however this research focuses on workplace architecture (offices).

Giuliano (1985) states that “*new technology inevitably affects the organisation of work*” and identifies three stages of office organisation characterised not only by its technology but also by its style of management, personal policies, hierarchy of supervisory and managerial staff, standards of performance and human relations among the people involved in the office and their clients. Following are the three office models according to Giuliano: the pre-industrial, the industrial and the information age office.

The **Pre-industrial office**, Figure 1 (left), depends on the performance of the individuals, without much benefit from machines. There is little systematic organisation. Each person works independently, physically moving around to retrieve a file. Individuals have different styles of work and human relations are important. Loyalty, understanding, and mutual respect are cornerstones to the company. The only way to overcome an increase on the work load is by hiring more employees.

The **Industrial office**, Figure 1 (centre), is a response to the limitations of the Pre-industrial office and introduces the principles of work simplification, specialisation, and time-and-motion efficiency. It is essentially a production line. Work moves from desk to desk as parts move along an assembly line. Jobs are simple, repetitive and unsatisfying. The fragmentation of responsibility created bureaucracy and proliferation of paperwork. Workers do not know the overall task to which they are contributing. Errors are compounded but not fixed. Everyone has to work together during the same hours in the same office to sustain the flow of paper. Tasks are isolated and work performance measured in an attempt to maximize efficiency and output. Even personal interaction is standardised.

The **Information age office**, Figure 1 (right), combines systems and machines to the benefit of workers and clients, but tries to maintain the values of the pre-industrial office. It exploits new technology, yet it returns to people-centred work rather than machine-centred work. The machine is paced to the needs and abilities of the person who works with it. Instead of executing a small number of steps repetitively for a large number of accounts, one individual handles all customer-related records. Staff reduction of as much as 50% is common. Information is updated as it becomes available, and there is no uncertainties related to the ‘work in process’. Productivity is not longer measured by hours of work or number of items processed, but by customer satisfaction.

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RESEARCH BACKGROUND PAGE 4/6

Evolution of workplace architecture as a consequence of technology development

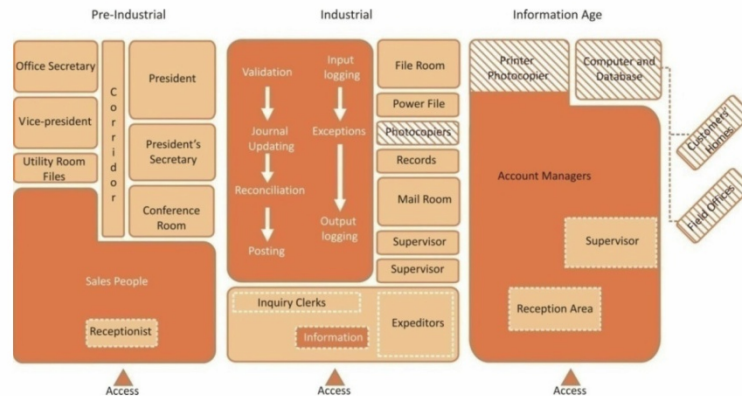


Figure 1. The Pre-Industrial, Industrial and Information Age Office, based on Giuliano (1985)

The rooms hatched on the Industrial and Information Age offices are rooms dedicated to host technology, or made possible only by communications technology (as in the case of the *Customers' Home* and *Field Offices* rooms of the Information Age office). Technology starts to claim physical space, but also blurs boundaries between geographic locations.

The Information age office as described above was Guiliano's vision in 1985, but as noted by the French poet Paul Valery "*The trouble with our times is that the future is not what it used to be*". Today's vision of the information age office is more radical. In fact there is no office, at least physically. Figure 2 shows a collage of images from *Second Places* environments, a UK company specialised in the development of collaboration environments based on Second Life.



Figure 2. Virtual environments hosted in Second Life, Second Places (2007)

RESEARCH BACKGROUND PAGE 5/6

Evolution of workplace architecture as a consequence of technology development

RESEARCH OBJECTIVE

The objective of this research is to study *how* and to *what extent* changes in technology are changing workplace architecture. The two main research questions are:

- a) To what extent is information technology changing workplace architecture?
- b) How is information technology changing workplace architecture?

The word '*evolution*' in the research title was chosen to allude to the Darwinian natural selection process to which the different variants of workplace architecture (mutations) are submitted. The variants which perform better will prevail over the others and redefine workplace architecture.

Empirical data collection

Three main data collection activities have taken place:

Survey

In 2007, 105 companies in Melbourne and its suburbs participated in a survey designed to provide a cross section of the current workplace environment and working habits. Refer to Appendix CSB-D for a sample of the survey.

The results of this survey allowed to identify (amongst other things):

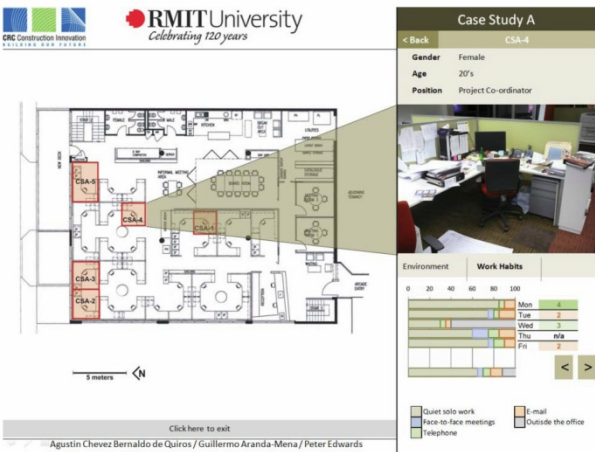
- Differences between working environments in the city and the suburbs;
- Differences between different types of work (accountants and designers);
- Differences between adapted spaces (e.g. former apartment unit currently used as an office) and purpose design offices;
- Level of technology adoption; and
- Level of adoption of Alternative Ways of Working (eg. Teleworking, hot-desking)

Case Study (CS-A) – Traditional office

Following the survey, a more in-depth case study was undertaken. For one week, five participants of a selected company used a Work Sampling Diary (WSD) to register their working habits (refer to Appendix CSB-C). The study included analysis of the floor plan and individual working stations. Participants also completed the above-mentioned survey. Figure 3 is a screenshot of the technique used to analyse and present the results.

RESEARCH BACKGROUND PAGE 6/6

Evolution of workplace architecture as a consequence of technology development



Case Study (CS-B) – Second Life office

This case study documents the processes and experiences of a company in Manchester, UK, that has adopted Second Life (a virtual world environment) to assist their work collaboration activities.



Figure 4. Virtual office hosted in Second Life

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Case Study CS-C Interview agenda

The following questions were composed based on the participant's background (refer to Chapter 6) for the face-to-face interview. It is noted that these questions were used only as a guideline.

- **Personal information**
 - Age?
 - How old is your daughter?
 - What is your husband's age?
 - What is your husband's profession?
- **Workplace information**
 - Describe the organisation that you work for.
 - How long have you been working for this organisation?
 - Describe the type of work that you do.
 - Do you enjoy your work?
 - How much do you depend on paper (print documents/access printed documents)?
 - How much do you depend on face-to-face meetings?
 - What technology do you need to do your work (e.g. computer, mobile, internet, etc)?
 - Why do you need to work in an office?
 - Because of technology?
 - Because of the people?
 - Because of security?
 - To get away from home?
- **Teleworking:**
 - Initially, what was your main motivation to work from home?
 - Other motivations?
 - What put you off? (besides de policy)
 - Expand on the home based working policy
 - Technology requirements
 - Security requirements
 - Is there any type of incentive
 - Is it an accessible document
 - Would you consider working from home in the future?
 - Once your children are older?
 - Under a more relaxed policy?
 - In your opinion, what are the advantages of working from home for you?
 - For your organisation?
 - The disadvantages for you?
 - For your organisation?

- Are you aware of peers working from home?
 - Is it encouraged?
 - Approximate percentage / Is it common?
 - Do you think teleworking can benefit your organisation?
 - Do you think working from home is a technology issue or management issue?
- **Other AWW**
 - Are there other AWW put in place at your organisation?
 - Hot-desking?
 - How comfortable would you feel if you need to share your desk?
 - How is performance measured in your job?
 - Can you modify your working hours as long as you maintain your performance?
 - How important is time flexibility for you at work
 - How important is place flexibility for you at work
- **What is your daily transport routine**
 - Type of transport
 - How many cars do you have?
 - Time
 - Distance
- **Conceptual questions**
 - How do you define work?
 - Do you think technology affects the way you work?
 - How would you describe the office of the future?
 - Do you think reaching the above vision depends on technology or management?
 - What do you think is the relationship between technology and society?
 - Do you think technology serves society?

Appendix 6e

Questionnaire / report key

QUESTIONNAIRE KEY

| QUESTIONNAIRE | | 1 1 1 |
|--|--|--|
| Please tick the box <input type="checkbox"/> next to your preferred answer. | | ID: _____ |
| Thank you for your co-operation! | | The identification number on the questionnaire is for monitoring and analysis purposes only. Your name and company will not be associated with the answers you give. |
| 1 In what type of building is your office located? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> 1 <input type="checkbox"/> Adapted home / apartment unit <input type="checkbox"/> Adapted warehouse or other non-office building <input type="checkbox"/> Office building or building designed for the organisation's activities </div> <div style="width: 65%;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">Poor</div> <div style="width: 35%; text-align: center;"><input type="checkbox"/> 2 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">B) Ventilation comfort</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 3 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">C) Illumination comfort</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 4 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">D) Background noise level</div> <div style="width: 35%; text-align: center;">Noisy <input type="checkbox"/> 5 <input type="checkbox"/></div> <div style="width: 30%;">Quiet</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">E) Frequency of distractions</div> <div style="width: 35%; text-align: center;">Frequent <input type="checkbox"/> 6 <input type="checkbox"/></div> <div style="width: 30%;">Rare</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">F) Visual privacy at your workstation</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 7 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">G) Voice privacy at your workstation</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 8 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">H) General spatial arrangement</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 9 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">I) General furniture arrangement</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 10 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">J) General office size</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 11 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">K) General office storage space</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 12 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">L) Individual storage space</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 13 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">M) Work space available on workstation</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 14 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">N) Overall space environment satisfaction</div> <div style="width: 35%; text-align: center;">Poor <input type="checkbox"/> 15 <input type="checkbox"/></div> <div style="width: 30%;">Good</div> </div> </div> </div> | | |
| 3 Which layout best describes your workplace? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> 16 <input type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access <input type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations </div> </div> | | |
| 4 On average, you are at your desk / workstation: | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">Rarely <input type="checkbox"/></div> <div style="width: 35%; text-align: center;"><input type="checkbox"/> 17 <input type="checkbox"/></div> <div style="width: 30%;">Most of the time</div> </div> | | |
| 5 Approximate percentage of time you spend in the following working modes: (Should add to 100%) | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> 18 % Individual work, and quiet thinking </div> <div style="width: 35%; text-align: center;"> 19 % Face-to-face collaboration </div> <div style="width: 30%;"> 20 % Building relationships, and socialising </div> </div> | | |
| 1 1 3 | | |
| 17 What type of computer do you have at work? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Desktop / non-portable </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> Laptop / 32 <input type="checkbox"/> tablet </div> <div style="width: 30%;"> <input type="checkbox"/> I do not have a computer </div> </div> | | |
| 18 Does your workplace have Internet connection? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> If Yes, please specify: <input type="checkbox"/> Dial-Up <input type="checkbox"/> Broadband <input type="checkbox"/> Wi 33 <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> No </div> </div> | | |
| 19 Does your company have a website? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Yes 34 </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> No </div> </div> | | |
| 20 Is there a wireless network at your workplace? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Yes 35 </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> No </div> </div> | | |
| 21 What type of monitors are used at your workplace? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Only CRT (non flat panel) </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 36 <input type="checkbox"/> </div> <div style="width: 30%;"> <input type="checkbox"/> Only flat panel </div> </div> | | |
| 22 Which scenario best describes the adoption of new technology in your workplace? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> We adopt technology after everyone else in our field </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 37 <input type="checkbox"/> </div> <div style="width: 30%;"> <input type="checkbox"/> We adopt technology before the majority in our field </div> </div> | | |
| 23 Does your workplace rely more on faxes or e-mails to receive and send information? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> E-mails </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 38 <input type="checkbox"/> </div> <div style="width: 30%;"> <input type="checkbox"/> Faxes </div> </div> | | |
| 24 Generally, non-spam e-mails, are: | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Always printed </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 39 <input type="checkbox"/> </div> <div style="width: 30%;"> <input type="checkbox"/> Never printed </div> </div> | | |
| 25 Are hardcopy documents scanned? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Yes 40 </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> No </div> </div> | | |
| 26 Are there policies in your workplace to reduce the use of: | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> A) Electricity <input type="checkbox"/> Yes 41 <input type="checkbox"/> No </div> <div style="width: 35%; text-align: center;"> yes, but not properly followed </div> <div style="width: 30%;"> <input type="checkbox"/> No </div> </div> | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> B) Water <input type="checkbox"/> Yes 42 <input type="checkbox"/> No </div> <div style="width: 35%; text-align: center;"> yes, but not properly followed </div> <div style="width: 30%;"> <input type="checkbox"/> No </div> </div> | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> C) Paper <input type="checkbox"/> Yes 43 <input type="checkbox"/> No </div> <div style="width: 35%; text-align: center;"> yes, but not properly followed </div> <div style="width: 30%;"> <input type="checkbox"/> No </div> </div> | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> D) Use of cars <input type="checkbox"/> Yes 44 <input type="checkbox"/> No </div> <div style="width: 35%; text-align: center;"> yes, but not properly followed </div> <div style="width: 30%;"> <input type="checkbox"/> No </div> </div> | | |
| 27 Are desks / workstations shared in your office? (E.g. Hot-desking) | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Yes 45 </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> No </div> </div> | | |
| 1 1 2 | | |
| 6 Which is the place where most productive work related interaction is done? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Meeting rooms <input type="checkbox"/> Each other's workstation / office <input type="checkbox"/> Informal environment within the office (Cafeteria / kitchen, etc.) <input type="checkbox"/> Somewhere outside the office (Coffee shop, etc.) </div> </div> | | |
| 7 How flexible is your workplace about when employees do their work? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Employees must work within a specific time frame <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 22 <input type="checkbox"/> </div> <div style="width: 30%;"> Employees can choose when to work as long as they meet their targets </div> </div> | | |
| 8 How flexible is your workplace about where employees do their work? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Work must be done at the office <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 23 <input type="checkbox"/> </div> <div style="width: 30%;"> Work may be done anywhere (home or other non-office environment) </div> </div> | | |
| 9 How important is face-to-face interaction with workmates in daily activities? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> No face-to-face interaction is required <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 24 <input type="checkbox"/> </div> <div style="width: 30%;"> Face to face interaction is essential in our daily activities </div> </div> | | |
| 10 Rank the level of bureaucracy at your workplace | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Procedures are relaxed <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 25 <input type="checkbox"/> </div> <div style="width: 30%;"> Procedures must be strictly followed </div> </div> | | |
| 11 Rank the level of interpersonal-competitiveness at your workplace | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Low <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 26 <input type="checkbox"/> </div> <div style="width: 30%;"> High </div> </div> | | |
| 12 How much do you depend on a computer for your daily work? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> I do not need a computer to do my work <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 27 <input type="checkbox"/> </div> <div style="width: 30%;"> I could not do my work without a computer </div> </div> | | |
| 13 On average, how many hours do you work per week? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> 28 </div> <div style="width: 35%; text-align: center;"> Hrs / per week </div> </div> | | |
| 14 Do you take work home? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Never <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 29 <input type="checkbox"/> </div> <div style="width: 30%;"> I work from home (Teleworker) </div> </div> | | |
| 15 Do you work on weekends? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Never <input type="checkbox"/> </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 30 <input type="checkbox"/> </div> <div style="width: 30%;"> Every weekend </div> </div> | | |
| 16 Are you happy with your work / life balance? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Yes 31 </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> No </div> </div> | | |
| 1 1 4 | | |
| 28 Which of the following you have at HOME? <small>Tick all applicable</small> | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> 46 Computer </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 47 Printer </div> <div style="width: 30%;"> <input type="checkbox"/> 48 Fax </div> </div> | | |
| 29 Is teleworking (working from home) an option at your workplace? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> If Yes, please specify: <input type="checkbox"/> I work from home _____ days a week </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> I would like to have the option of working from home </div> <div style="width: 30%;"> If No, please specify: <input type="checkbox"/> I do not use this option, I rather go to the office </div> </div> | | |
| 30 Which do you think are the pros and cons of working from home? <small>Tick all applicable</small> | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> 52 Pros <input type="checkbox"/> More free time <input type="checkbox"/> 53 Increased productivity <input type="checkbox"/> 54 Less commuting time <input type="checkbox"/> 55 Freeing up of office space <input type="checkbox"/> 56 More time with my family </div> <div style="width: 35%; text-align: center;"> 57 Cons <input type="checkbox"/> Isolation <input type="checkbox"/> 58 Longer working hours <input type="checkbox"/> 59 Lack of motivation <input type="checkbox"/> 60 Lack of a suitable environment at home <input type="checkbox"/> 61 No boundaries between home and work </div> </div> | | |
| 31 On average, how much time does it take to commute? (Return) | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> H 62 </div> <div style="width: 35%; text-align: center;"> Min </div> </div> | | |
| 32 On a typical day, which is your main way of transportation to get to work? | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> By foot / Bicycle </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> Public transport 63 </div> <div style="width: 30%;"> <input type="checkbox"/> Scooter / Motorcycle <input type="checkbox"/> Car </div> </div> | | |
| 33 How many people work at your company? (Including yourself) | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> 1-10 <input type="checkbox"/> 11-20 <input type="checkbox"/> 21-40 <input type="checkbox"/> 64 <input type="checkbox"/> 61-99 <input type="checkbox"/> 100-150 <input type="checkbox"/> 151+ </div> </div> | | |
| 34 Your age group | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> 20's <input type="checkbox"/> 30's <input type="checkbox"/> 65 <input type="checkbox"/> 40's <input type="checkbox"/> 50's <input type="checkbox"/> 60's <input type="checkbox"/> 70's + </div> </div> | | |
| 35 Your gender | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Male </div> <div style="width: 35%; text-align: center;"> <input type="checkbox"/> 66 female </div> </div> | | |
| 36 Your position in the company: (e.g. director, manager, sales, production, secretarial, etc.) | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> 67 </div> </div> | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Please insert the questionnaire into the provided pre-paid envelope and send it at your soonest convenience. </div> <div style="width: 35%; text-align: center; background-color: #333; color: white; padding: 5px;"> THANK YOU! </div> </div> | | |

REPORT KEY

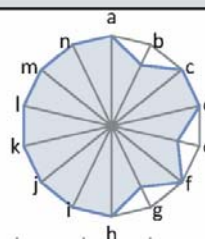
Questionnaire ID:

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|----|--|----------------------------------|
| Type of Building..... | 1 | Office building or building designed for the organisation's activities | |
| Layout..... | 16 | Combination: Enclosed/Open Plan | Number of employees 64 21-40 |
| Respondent's: Age..... | 65 | 30's | Gender 66 M Position 67 Director |

Office Environment

| | | | | | |
|-----------------------------------|---|---|-------------------------------|----|---|
| a) Temperature comfort..... | 2 | 4 | h) Spatial arrangement..... | 9 | 4 |
| b) Ventilation comfort..... | 3 | 3 | i) Furniture arrangement..... | 10 | 4 |
| c) Illumination comfort..... | 4 | 4 | j) Office size..... | 11 | 4 |
| d) Noise comfort..... | 5 | 4 | k) Office storage..... | 12 | 4 |
| e) Frequency of distractions..... | 6 | 3 | l) Storage space..... | 13 | 4 |
| f) Visual privacy..... | 7 | 4 | m) Space on workstation..... | 14 | 4 |
| g) Voice privacy..... | 8 | 3 | n) Overall satisfaction..... | 15 | 4 |



Type of work

| | | |
|--------------------------------|----|----|
| a) Individual Work..... | 18 | 70 |
| b) Face to Face..... | 19 | 20 |
| c) Building Relationships..... | 20 | 10 |

100 0 10 20 30 40 50 60 70 80 90 100

Work / Life Balance

| | | | | | |
|-----------------------------|----|----|-----------------------|----|-----------|
| Working hrs. Per week..... | 28 | 45 | Work on weekends..... | 30 | Sometimes |
| Happy with W/L Balance..... | 31 | No | Take work home..... | 29 | Never |

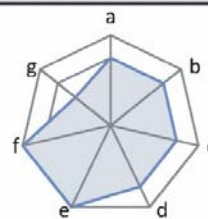
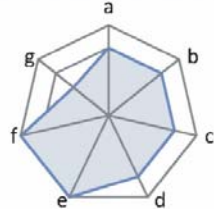
Technology at work

| | | | | | |
|----------------------------|----|----------------------------|----------------------------|----|----------------|
| Adopter type..... | 37 | Late Majority | Company has a website..... | 34 | Yes |
| Type of computer..... | 32 | Desktop / non-portable | Documents are scanned..... | 40 | Yes |
| Internet connection..... | 33 | Broadband | E-mails are..... | 39 | Rarely printed |
| Wireless network..... | 35 | No | | | |
| E-mails vs. Fax..... | 38 | Mostly E-mails, some Faxes | | | |
| Type of monitors used..... | 36 | Only Flat panel | | | |

Technology at home: 46 47 48 49 50 and / Wireless Connection

Alternative Ways of Working (AWW)

| | | | | |
|--------------------------------------|-------------|---|----|---|
| Alternative Ways of Working (AWW) | | | | |
| a) Time flexibility..... | 22 | 3 | | |
| b) Place flexibility..... | 23 | 3 | | |
| c) Face-to-face interaction (2)..... | 24 | 3 | | |
| d) Bureaucracy level (2)..... | 25 | 3 | | |
| e) Competitiveness (1)..... | 26 | 4 | | |
| f) Computer dependency..... | 27 | 4 | | |
| g) Workstation dependency (3)..... | 17 | 2 | | |
| Hot-desking implemented..... | 45 | No | | |
| Preferred interaction space..... | 21 | Each other's workstation / office | | |
| Teleworking option offered..... | 51 | Yes, but I do not use this option, I rather go to the office. | | |
| 'Green' policies in place..... | 41 42 43 44 | Water, Paper, Use of Car | | |
| Perceived advantages of AWW | | Perceived disadvantages (AWW) | | |
| More free time..... | 52 | Isolation..... | 57 | ✓ |
| Increased productivity..... | 53 | Longer working hrs..... | 58 | |
| Less commuting time..... | 54 | Lack of motivation..... | 59 | |
| Freeing up of office space..... | 55 | Lack of suitable environment..... | 60 | |
| More time with family..... | 56 | No boundaries Home/Work..... | 61 | ✓ |



Commuting time (Return-min) 62 75 min by Car 63
Office located in:

Error monitoring

The following is an analysis into the frequency of errors and input times of Person A and B whilst introducing data using the developed data input process discussed in Chapter 7.

Frequency of errors

Analysis of input errors committed per set of received questionnaires reveals that Person A reduced his rate of input errors committed as time passed by, registering 32 errors in the first third of questionnaires (1 to 35), 16 errors in the second third (36 to 71) and 14 errors in the last third (72 to 105). On the other hand, Person B accumulated 14 errors in the first third, 22 in the second and 2 in the last third. Refer to Figure 1.

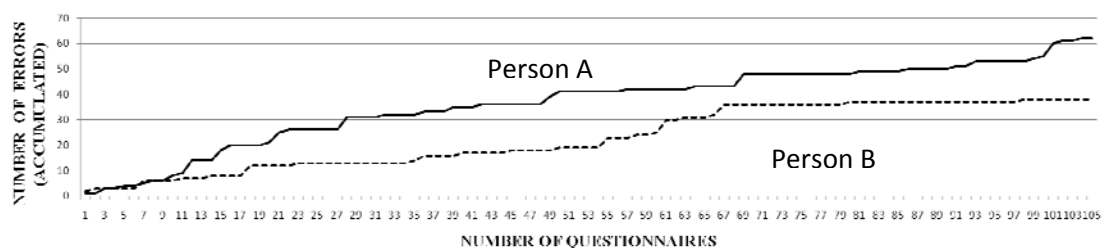


Figure 1: Plot of accumulated input errors committed during Inputs A and B

It is difficult to assert that this represents a '*learning curve*' effect on data entry reliability, but this may be so, coupled with increasing confidence in personal judgement when encountering problems such as those discussed in Chapter 7.

Time

Table 1 displays the data input times by Persons A and B for Inputs 1 and 2 and for each lot of questionnaires returned (1-35, 36-71, 72-105). From the table it can be seen that the overall input time is just over 14 hours, with a difference of 2 hours and 26 minutes between Input A (8:15hrs) and Input B (5:49hrs). This table also illustrates a decrease in keying time between the first and the second lot of questionnaires and a decrease again between the second and third. This apparent trend for Inputs 1 and 2 of Persons A and B, suggests that they both became more dexterous in keying data as time progressed.

Table 1: Inputting time (HH:MM:SS)

| | Input A1 | Input A2 | Input B1 | Input B2 |
|-----------------------|----------|----------|----------|----------|
| 1st Third (1-35) | 01:53:00 | 01:29:00 | 01:18:00 | 01:00:00 |
| 2nd Third (36-71) | 01:28:00 | 01:12:00 | 01:06:00 | 00:55:00 |
| 3rd Third (72-105) | 01:11:00 | 01:02:00 | 00:45:00 | 00:45:00 |
| Sub-total (by Input) | 04:32:00 | 03:43:00 | 03:09:00 | 02:40:00 |
| Sub-total (by Person) | 08:15:00 | | 05:49:00 | |
| Total (hh:mm:ss) | 14:04:00 | | | |

Another consistent trend is that the keying time of Input 2 was in all cases faster than Input 1. This could indicate that:

- more 'care' was taken whilst keying Input 1; or
- given that the second input immediately followed the first input, some of the responses may have been recalled and input faster; or
- a combination of both of these. Table 1 also shows that Person B achieved the greatest level of dexterity on the last third of questionnaires (45 minutes), averaging one second per input of single data (reading and typing).

The times displayed in Table 1 are those taken to actually input the data. However, the complete data entry process was performed over several days. Referring to Figure 2, Person A completed his input in 6 days. Day breaks, denoted with thick vertical lines, were taken after the input of questions 21, 25, 50, 85 and 89. Three breaks with a minimum duration of two hours, denoted with thin lines, were taken by Person A after the input of questions 18, 40 and 104.

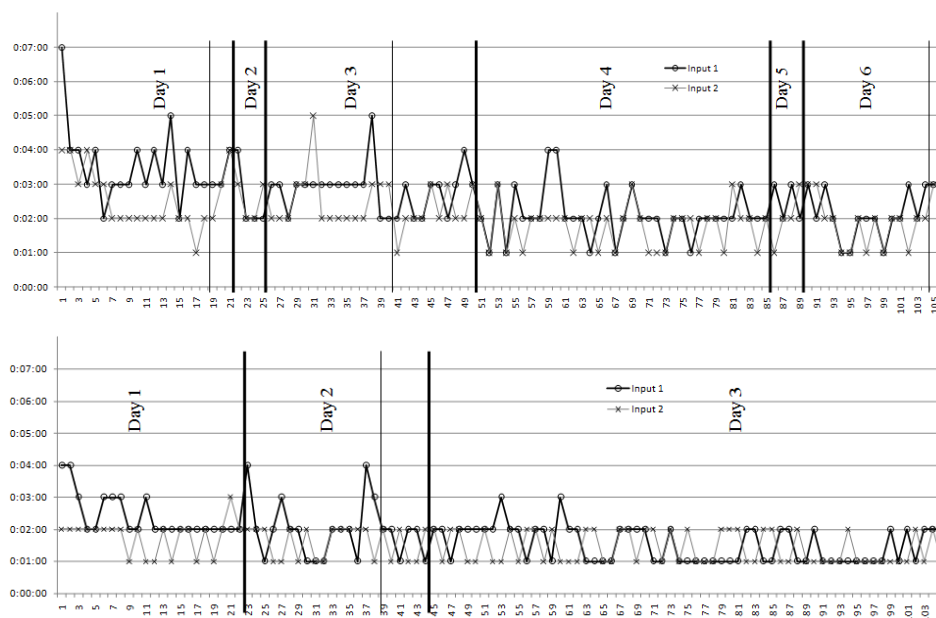


Figure 2: Plot of times for Inputs 1& 2 for Person A (above) and Person B (below)

From the above table, Person B completed his input in 3 days, with day breaks taken each time after the input of questions 22 and 44. Only one two hour break was taken by Person B after the input of question 38.

After comparing Figure 2 with the accumulated error plot (Figure 1), it can be observed that Person A did not achieve the same level of proficiency as Person B. The former not only took longer and showed a more chaotic inputting rhythm, but also committed more mistakes.

Quality of data provided by respondents

The following tables identify and discuss 15 questions that were answered by at least one respondent in such a way that error could have been introduced to the research. The questionnaire(s) affected are identified and the adopted solution described on the comments row.

| | |
|---|--|
| Question Number: | 3 |
| Questionnaire(s): | AS-38, BC-19, BC-32, BC-53, BS-05, BS-21, BS-54, BS-71 |
| Representative examples only (from AS-38 to BS-05) | |
| <div> <div> 3 Which layout best describes your workplace? <div> <input type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access </div> <div> <input type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations </div> </div> <i>both</i> </div> <div> <div> 3 Which layout best describes your workplace? <div> <input type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access </div> <div> <input checked="" type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations </div> </div> <i>combination</i> </div> <div> <div> 3 Which layout best describes your workplace? <div> <input checked="" type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access </div> <div> <input checked="" type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations </div> </div> <i>Both 50/50 ME</i> </div> <div> <div> 3 Which layout best describes your workplace? <div> <input checked="" type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access </div> <div> <input checked="" type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations </div> </div> <i>both</i> </div> <div> <div> 3 Which layout best describes your workplace? <div> <input checked="" type="checkbox"/> Enclosed: Consists of individual rooms (full height walls) with a corridor for access </div> <div> <input checked="" type="checkbox"/> Open-plan: No internal walls or fixed partitions, space is divided by workstations </div> </div> <i>combination</i> </div> | |
| Comments: | As seen on the above examples, 8 respondents marked both boxes or wrote 'Combination'. Thus, Option 3 "Combination of enclosed and Open-plan" is adopted by the research. However, It is acknowledged that by doing so, error may be introduced to the study as some respondents that chose Options 1 or 2, might have chosen Option 3 if offered. |

| | |
|--|--|
| Question Number: | 8 |
| Questionnaire(s): | XX-01 |
| <div style="border: 1px solid black; padding: 10px;"> <div style="background-color: #e0e0e0; padding: 5px; margin-bottom: 10px;"> 8 How flexible is your workplace about <u>where</u> employees do their work? </div> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;"> Work must be done at the office </div> <div style="text-align: center;"> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input checked="" type="checkbox"/> 4 <input type="checkbox"/> </div> <div style="text-align: center;"> Work may be done anywhere (home or other non-office environment) </div> </div> </div> | |
| Comments: | The intention of scales with no central point is to prevent respondents to adopt a neutral position and force them to take a side. This answer cannot be used as no correct assumption can be made to determine which side of the scale it belongs to. |

| | |
|--|---|
| Question Number: | 9 |
| Questionnaire(s): | BC-62 |
| <div> <div>9</div> <div> <p>How important is face-to-face interaction with workmates in daily activities?</p> <div> <div>No face-to-face interaction is required</div> <div>1 <input type="checkbox"/></div> <div>2 <input type="checkbox"/></div> <div>3 <input checked="" type="checkbox"/></div> <div>4 <input checked="" type="checkbox"/></div> <div>Face to face interaction is essential in our daily activities</div> </div> </div> </div> | |
| Comments: | Although similar to Question 9 (above), this case tends to the right hand scale. Thus, the response can be safely used assuming that it tends to the right hand of the scale. The value '3' is used for analysis. |

| | |
|---|---|
| Question Number: | 13 |
| Questionnaire(s): | AC-12, XX-01 |
| <div> <div>13</div> <div>On average, how many hours do you work <u>per week</u>?</div> <div>45 - 50</div> <div>Hrs / per week</div> </div> | |
| <div> <div>13</div> <div>On average, how many hours do you work <u>per week</u>?</div> <div>37.5</div> <div>Hrs / per week</div> <div>- 40.0</div> </div> | |
| Comments: | As with the rest of the respondents, it was expected that a single average figure was registered in the box. In the case of AC-12 (45-50) and XX-01 (37.5-40.0) respondents' answers are grouped within the study ranges accordingly. |

| | |
|---|---|
| Question Number: | 17 |
| Questionnaire(s): | AC-27, AC-50, AC-61. BC-12, BC-25, BC-71, BS-21 |
| Representative responses shown | |
| <div> <div>17</div> <div>What type of computer do you have at work?</div> <div> <div>1 <input checked="" type="checkbox"/> Desktop / non-portable</div> <div>2 <input checked="" type="checkbox"/> Laptop / portable</div> <div>3 <input type="checkbox"/> I do not have a computer</div> </div> </div> | |
| <div> <div>17</div> <div>What type of computer do you have at work?</div> <div> <div>1 <input checked="" type="checkbox"/> Desktop / non-portable</div> <div>2 <input checked="" type="checkbox"/> Laptop / portable</div> <div>3 <input type="checkbox"/> I do not have a computer</div> </div> </div> | |
| <div> <div>17</div> <div>What type of computer do you have at work?</div> <div> <div>1 <input checked="" type="checkbox"/> Desktop / non-portable</div> <div>2 <input checked="" type="checkbox"/> Laptop / portable</div> <div>3 <input type="checkbox"/> I do not have a computer</div> </div> </div> <p style="text-align: center; color: red;">Both</p> | |
| Comments: | Similar to Question 3, respondents selected more than one option when a single response was expected. The combination of both responses (1&2) was adopted in the study. Code 4 was adopted by the research to denote combination of Option 1 and 2. |

| | |
|---|---|
| Question Number: | 18 |
| Questionnaire(s): | AC-05, AC-08, AC-50, AC-51, AC-61, AS-48, AS-66, AS-71, BC-19, BC-32, BC-60, BC-62, BC-71, BS-57, XX-01 |
| Representative response shown | |
| <div> <div>18</div> <div>Does your workplace have Internet connection?</div> <div> If Yes, please specify: 1 <input type="checkbox"/> Dial-Up 2 <input checked="" type="checkbox"/> Broadband 3 <input checked="" type="checkbox"/> Wireless 4 <input type="checkbox"/> No </div> </div> | |
| Comments: | In all instances code '3' is used as it encompasses broadband and wireless. |

| | |
|--|---|
| Question Number: | 19 |
| Questionnaire(s): | BS-59 |
| <div> <div>19</div> <div>Does your company have a website?</div> <div> 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No <i>been built</i> </div> </div> | |
| Comments: | The company does not have a published website at the time of the survey. Thus, option 2, "No" is used for analysis. |

| | |
|--|-----------------------------------|
| Question Number: | 21 |
| Questionnaire: | AC-55, AC-61 |
| <div> <div>21</div> <div>What type of monitors are used at your workplace?</div> <div> Only CRT (non flat panel) 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Only flat panel <i>Both</i> </div> </div> | |
| <div> <div>21</div> <div>What type of monitors are used at your workplace?</div> <div> Only CRT (non flat panel) 1 <input checked="" type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input checked="" type="checkbox"/> 4 <input checked="" type="checkbox"/> Only flat panel <i>how do you answer this?</i> </div> </div> | |
| Comments: | Data cannot be used for analysis. |

| | |
|--|-----------------------------------|
| Question Number: | 23 |
| Questionnaire(s): | AC-55, BC-26 |
| <div> <div>23</div> <div>Does your workplace rely more on faxes or e-mails to receive and send information?</div> <div> E-mails 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input checked="" type="checkbox"/> Faxes </div> </div> | |
| <div> <div>23</div> <div>Does your workplace rely more on faxes or e-mails to receive and send information?</div> <div> E-mails 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input checked="" type="checkbox"/> Faxes <i>1 clients use both</i> </div> </div> | |
| Comments: | Data cannot be used for analysis. |

Appendix 7b

| | |
|---|---|
| Question Number: | 28 |
| Questionnaire: | BC-36, BC-38, XX-02 |
| <p>28 Which of the following you have at HOME? <i>Tick all applicable</i></p> <p>1 <input type="radio"/> Computer 2 <input type="radio"/> Printer 3 <input type="radio"/> Fax 4 <input type="radio"/> Dial-up / 5 <input checked="" type="radio"/> Broadband / wireless Internet</p> | |
| <p>28 Which of the following you have at HOME? <i>Tick all applicable</i></p> <p>1 <input checked="" type="radio"/> Computer 2 <input checked="" type="radio"/> Printer 3 <input checked="" type="radio"/> Fax 4 <input checked="" type="radio"/> Dial-up / 5 <input checked="" type="radio"/> Broadband / wireless Internet</p> | |
| <p>28 Which of the following you have at HOME? <i>Tick all applicable</i></p> <p>1 <input type="radio"/> Computer 2 <input type="radio"/> Printer 3 <input type="radio"/> Fax 4 <input type="radio"/> Dial-up / 5 <input type="radio"/> Broadband / wireless Internet</p> | |
| Comments: | In the case of BC-36, the respondent did not tick 'Computer'. However, it is assumed that a computer or similar device (PDA) is needed to access Internet. Thus, Option 1 is also taken into consideration for analysis. In the case of BC-38, the respondent ticked Option 4 and 5. Option 5 is used for analysis. In the case of XX-02, the 'ticks' look more like dots, making it uncertain to determine if they are actually ticked. However, Option 1,2,3 and 5 are used for analysis. |

| | |
|---|--|
| Question Number: | 29 |
| Questionnaire(s): | AC-55, AS-04, BS-57 |
| Representative response shown | |
| <p>29 Is teleworking (working from home) an option at your workplace?</p> <p>If Yes, please specify:</p> <p>1 <input type="checkbox"/> I work from home <input type="checkbox"/> days a week</p> <p>2 <input checked="" type="checkbox"/> I do not use this option, I rather go to the office</p> <p>If No, please specify:</p> <p>3 <input type="checkbox"/> I would like to have the option of working from home</p> <p>4 <input type="checkbox"/> I rather go to the office</p> | |
| Comments: | Option 5 is created and use for analysis to reflect that regardless whether teleworking is an option or not, the respondents would rather go to the office. |
| Questionnaire: | AS-05, AS-07, AS-46, BS-24 |
| Representative response shown | |
| <p>29 Is teleworking (working from home) an option at your workplace?</p> <p>If Yes, please specify:</p> <p>1 <input checked="" type="checkbox"/> I work from home <input type="checkbox"/> days a week</p> <p>2 <input type="checkbox"/> I do not use this option, I rather go to the office</p> <p>If No, please specify:</p> <p>3 <input type="checkbox"/> I would like to have the option of working from home</p> <p>4 <input type="checkbox"/> I rather go to the office</p> | |
| Comments: | These four respondents do not telework, but in fact work from home (small business/sole practitioners). This was concluded after analysing responses provided on questions 3, 14, 31 and 32. For it to be considered teleworking the respondent needs to have an office outside their home to which they go o work. Option 6 "Home office" is created and used for analysis. |
| Questionnaire: | AS-33 |
| <p>29 Is teleworking (working from home) an option at your workplace?</p> <p>If Yes, please specify:</p> <p>1 <input checked="" type="checkbox"/> I work from home <input type="checkbox"/> days a week</p> <p>2 <input type="checkbox"/> I do not use this option, I rather go to the office</p> <p>If No, please specify:</p> <p>3 <input type="checkbox"/> I would like to have the option of working from home</p> <p>4 <input type="checkbox"/> I rather go to the office</p> | |
| Comments: | "Rarely" cannot be quantified and used within the range of responses. Option 2 is used for analysis. |
| Questionnaire: | BC-19 |

| | |
|-------------------------|---|
| <p>29</p> | <p>Is teleworking (working from home) an option at your workplace?</p> <p>If Yes, please specify:</p> <p>1 <input checked="" type="checkbox"/> I work from home 2 <input type="checkbox"/> days a week <i>weekend</i></p> <p>2 <input type="checkbox"/> I do not use this option, I rather go to the office</p> <p>If No, please specify:</p> <p>3 <input type="checkbox"/> I would like to have the option of working from home</p> <p>4 <input type="checkbox"/> I rather go to the office</p> |
| <p>Comments:</p> | <p>It is not considered to be teleworking if it is done on weekends. Option 2 is used for analysis.</p> |

| | |
|--------------------------------|---|
| <p>Question Number:</p> | <p>31</p> |
| <p>Questionnaire:</p> | <p>AC-55</p> |
| <p>31</p> | <p>On average, how much time does it take to commute? (Return)</p> <p>1 <input type="text" value="25"/> Hrs 2 <input type="text" value=""/> Min</p> <p><i>live at Phillip Island + come to the city each day</i></p> |
| <p>Comments:</p> | <p>It is assumed that a weekly estimate was provided. Thus, 25hrs is divided by 5 (working days) which totals 5 hours.</p> |

| | |
|--------------------------------|--|
| <p>Question Number:</p> | <p>32</p> |
| <p>Questionnaire:</p> | <p>BC-19, BC-63</p> |
| <p>32</p> | <p>On a typical day, which is your <u>main</u> way of transportation to get to work?</p> <p>1 <input type="checkbox"/> By foot / Bicycle 2 <input type="checkbox"/> Public transport 3 <input checked="" type="checkbox"/> Scooter / Motorcycle 4 <input checked="" type="checkbox"/> Car</p> |
| <p>32</p> | <p>On a typical day, which is your <u>main</u> way of transportation to get to work?</p> <p>1 <input type="checkbox"/> By foot / Bicycle 2 <input checked="" type="checkbox"/> Public transport 3 <input type="checkbox"/> Scooter / Motorcycle 4 <input checked="" type="checkbox"/> Car</p> |
| <p>Comments:</p> | <p>Developing an assumption that would allow us to use these two responses could introduce error to the other responses. Thus, these responses are not taken into consideration for analysis.</p> |

| | |
|--------------------------------|--|
| <p>Question Number:</p> | <p>34</p> |
| <p>Questionnaire:</p> | <p>AC-12, BC-37</p> |
| <p>34</p> | <p>Your age group 1 <input checked="" type="checkbox"/> 20's 2 <input checked="" type="checkbox"/> 30's 3 <input type="checkbox"/> 40's 4 <input type="checkbox"/> 50's 5 <input type="checkbox"/> 60's 6 <input type="checkbox"/> 70's +</p> |
| <p>34</p> | <p>Your age group 1 <input type="checkbox"/> 20's 2 <input type="checkbox"/> 30's 3 <input type="checkbox"/> 40's 4 <input checked="" type="checkbox"/> 50's 5 <input checked="" type="checkbox"/> 60's 6 <input type="checkbox"/> 70's +</p> |
| <p>Comments:</p> | <p>It is assumed that the respondents are in their middle 20's (AC-12) and middle 50's (BC-37). Thus, Option 1 and 4 were used, respectively.</p> |

| | |
|--------------------------------|---|
| <p>Question Number:</p> | <p>35</p> |
| <p>Questionnaire:</p> | <p>AC-12</p> |
| <p>35</p> | <p>Your gender 1 <input checked="" type="checkbox"/> Male (<i>less</i>) 2 <input checked="" type="checkbox"/> Female</p> |
| <p>Comments:</p> | <p>No correct assumption can be made. Therefore, this answer is not taken into consideration for analysis.</p> |

Analysis supporting tables

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A7C.1 DESCRIPTIVE STATICS SUMMARY

Table 7c.1. Descriptive statistics summary (Questions 1 to 5)

| ID | Count | Min | Max | Mean | Mode | Median | Standard deviation | Sample variance | Skewness |
|------------|-------|-----|-----|-------------|------|--------|--------------------|-----------------|----------|
| 1 | 101 | 1 | 3 | 2.67 | 3 | 3 | 0.6182 | 0.3822 | -1.7279 |
| 2.A | 105 | 1 | 4 | 3.01 | 3 | 3 | 0.8492 | 0.7211 | -0.4986 |
| 2.B | 105 | 1 | 4 | 3.02 | 3 | 3 | 0.9092 | 0.8266 | -0.5858 |
| 2.C | 105 | 2 | 4 | 3.22 | 3 | 3 | 0.7335 | 0.5381 | -0.3695 |
| 2.D | 105 | 1 | 4 | 2.91 | 3 | 3 | 0.9314 | 0.8676 | -0.3364 |
| 2.E | 105 | 1 | 4 | 2.86 | 3 | 3 | 0.8708 | 0.7582 | -0.2509 |
| 2.F | 105 | 1 | 4 | 2.78 | 4 | 3 | 1.1092 | 1.2304 | -0.4152 |
| 2.G | 105 | 1 | 4 | 2.39 | 1 | 2 | 1.1223 | 1.2595 | 0.1339 |
| 2.H | 103 | 1 | 4 | 3.27 | 4 | 3 | 0.7435 | 0.5528 | -0.6338 |
| 2.I | 105 | 1 | 4 | 3.25 | 3 | 3 | 0.7568 | 0.5727 | -0.7201 |
| 2.J | 105 | 1 | 4 | 3.42 | 4 | 4 | 0.7309 | 0.5342 | -1.1440 |
| 2.K | 105 | 1 | 4 | 2.86 | 4 | 3 | 1.0690 | 1.1429 | -0.4313 |
| 2.L | 105 | 1 | 4 | 2.96 | 4 | 3 | 0.9896 | 0.9793 | -0.5295 |
| 2.M | 105 | 1 | 4 | 3.32 | 4 | 3 | 0.7403 | 0.5480 | -0.7473 |
| 2.N | 105 | 1 | 4 | 3.30 | 3 | 3 | 0.7088 | 0.5024 | -0.6811 |
| 3 | 105 | 1 | 3 | <i>n.a.</i> | 2 | 2 | 0.6064 | 0.3678 | 0.2611 |
| 4 | 105 | 2 | 4 | 3.52 | 4 | 4 | 0.6060 | 0.3672 | -0.8856 |
| 5.1 | 104 | 10 | 100 | 61.27 | 80 | 62.5 | 22.4410 | 503.5967 | -0.5115 |
| 5.2 | 103 | 2 | 60 | 23.90 | 20 | 20 | 13.9639 | 194.9905 | 0.8044 |
| 5.3 | 97 | 1 | 100 | 16.87 | 5 | 10 | 16.2016 | 262.4923 | 2.2716 |

Table 7c.2. Descriptive statistics summary (Questions 6 to 36)

| ID | Count | Min | Max | Mean | Mode | Median | Standard deviation | Sample variance | Skewness |
|------|-------------|-------------|-------------|-------------|-------------|-------------|--------------------|-----------------|-------------|
| 6 | 105 | 1 | 4 | 1.92 | 2 | 2 | 0.7683 | 0.5903 | 1.1688 |
| 7 | 105 | 1 | 4 | 2.52 | 3 | 3 | 1.0293 | 1.0595 | -0.1191 |
| 8 | 104 | 1 | 4 | 1.99 | 2 | 2 | 0.9603 | 0.9222 | 0.6901 |
| 9 | 105 | 1 | 4 | 3.02 | 3 | 3 | 0.8877 | 0.7881 | -0.7101 |
| 10 | 105 | 1 | 4 | 2.21 | 2 | 2 | 0.9374 | 0.8788 | 0.2093 |
| 11 | 105 | 1 | 4 | 2.03 | 2 | 2 | 0.8600 | 0.7396 | 0.4070 |
| 12 | 105 | 1 | 4 | 3.82 | 4 | 4 | 0.6010 | 0.3612 | -3.7025 |
| 13 | 105 | 7.5 | 80 | 45.70 | 40 | 45 | 11.3744 | 129.3779 | 0.2006 |
| 14 | 105 | 1 | 5 | 2.30 | 2 | 2 | 1.0554 | 1.1139 | 0.6811 |
| 15 | 105 | 1 | 4 | 2.05 | 2 | 2 | 0.8364 | 0.6996 | 0.5124 |
| 16 | 105 | 1 | 2 | 1.28 | 1 | 1 | 0.4493 | 0.2018 | 1.0157 |
| 17 | 105 | 1 | 4 | 1.52 | 1 | 1 | 0.8097 | 0.6557 | 1.8601 |
| 18 | 105 | 1 | 3 | 2.19 | 2 | 2 | 0.5018 | 0.2518 | 0.3342 |
| 19 | 105 | 1 | 2 | 1.25 | 1 | 1 | 0.4337 | 0.1881 | 1.1865 |
| 20 | 104 | 1 | 2 | 1.55 | 2 | 2 | 0.5001 | 0.2501 | -0.1960 |
| 21 | 103 | 1 | 4 | 3.41 | 4 | 4 | 0.9542 | 0.9105 | -1.3877 |
| 22 | 105 | 1 | 5 | 3.36 | 4 | 3 | 1.0107 | 1.0216 | -0.3259 |
| 23 | 103 | 1 | 3 | 1.39 | 1 | 1 | 0.6141 | 0.3771 | 1.3449 |
| 24 | 105 | 1 | 4 | 2.86 | 3 | 3 | 0.8817 | 0.7775 | -0.2294 |
| 25 | 103 | 1 | 2 | 1.45 | 1 | 1 | 0.4996 | 0.2496 | 0.2180 |
| 26.A | 105 | 1 | 3 | 2.30 | 3 | 3 | 0.8562 | 0.7332 | -0.6353 |
| 26.B | 105 | 1 | 3 | 2.43 | 3 | 3 | 0.8419 | 0.7088 | -0.9534 |
| 26.C | 105 | 1 | 3 | 1.87 | 1 | 2 | 0.8212 | 0.6744 | 0.2532 |
| 26.D | 105 | 1 | 3 | 2.52 | 3 | 3 | 0.7978 | 0.6364 | -1.2375 |
| 27 | 104 | 1 | 2 | 1.80 | 2 | 2 | 0.4034 | 0.1627 | -1.5069 |
| 28.1 | 103 | 1 | 1 | 1.00 | 1 | 1 | 0.0000 | 0.0000 | <i>n.a.</i> |
| 28.2 | 87 | 1 | 1 | 1.00 | 1 | 1 | 0.0000 | 0.0000 | <i>n.a.</i> |
| 28.3 | 29 | 1 | 1 | 1.00 | 1 | 1 | 0.0000 | 0.0000 | <i>n.a.</i> |
| 28.4 | 13 | 1 | 1 | 1.00 | 1 | 1 | 0.0000 | 0.0000 | <i>n.a.</i> |
| 28.5 | 83 | 1 | 1 | 1.00 | 1 | 1 | 0.0000 | 0.0000 | <i>n.a.</i> |
| 29 | 104 | 2 | 14 | 4.92 | 4 | 4 | 3.3608 | 11.2950 | 1.3400 |
| 30 | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> | <i>n.a.</i> |
| 31 | 102 | 1 | 300 | 61.02 | 60 | 60 | 43.5985 | 1900.8313 | 1.8990 |
| 32 | 100 | 1 | 4 | 3.19 | 4 | 4 | 1.1951 | 1.4282 | -0.9196 |
| 33 | 105 | 1 | 7 | 2.21 | 1 | 1 | 1.9100 | 3.6480 | 1.6271 |
| 34 | 105 | 1 | 5 | 3.03 | 4 | 3 | 1.0959 | 1.2011 | -0.0574 |
| 35 | 104 | 1 | 2 | 1.36 | 1 | 1 | 0.4811 | 0.2314 | 0.6114 |
| 36 | 104 | 1 | 8 | 2.45 | 1 | 1 | 1.9202 | 3.6870 | 0.9851 |

A7C.2 CORRELATION ANALYSIS

Six questionnaires¹ are not taken into account for the correlation analysis as they have at least one no-response.

Table 7c.3. Correlation table (Questions Q.2a-Q.2j to Q.34)

| | | | | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Q.2.A | Q.2.A | | | | | | | | | |
| Q.2.B | 0.7172 | Q.2.B | | | | | | | | |
| Q.2.C | 0.4921 | 0.4658 | Q.2.C | | | | | | | |
| Q.2.D | 0.2022 | 0.1773 | 0.2632 | Q.2.D | | | | | | |
| Q.2.E | 0.2155 | 0.2032 | 0.1642 | 0.4141 | Q.2.E | | | | | |
| Q.2.F | 0.1696 | 0.1542 | 0.1830 | 0.2283 | 0.1975 | Q.2.F | | | | |
| Q.2.G | 0.2646 | 0.2304 | 0.2527 | 0.3191 | 0.2460 | 0.7310 | Q.2.G | | | |
| Q.2.H | 0.2776 | 0.3321 | 0.3132 | 0.3094 | 0.2121 | 0.2680 | 0.3285 | Q.2.H | | |
| Q.2.I | 0.2460 | 0.3341 | 0.2437 | 0.3540 | 0.2270 | 0.2412 | 0.3226 | 0.7012 | Q.2.I | |
| Q.2.J | 0.2157 | 0.4078 | 0.2318 | 0.2181 | 0.1985 | 0.2434 | 0.2753 | 0.6156 | 0.6466 | Q.2.J |
| Q.2.K | 0.2137 | 0.2241 | 0.3014 | 0.2752 | 0.2145 | 0.2527 | 0.3476 | 0.5569 | 0.5711 | 0.6167 |
| Q.2.L | 0.1548 | 0.2678 | 0.2919 | 0.3120 | 0.1820 | 0.2774 | 0.4067 | 0.6099 | 0.6685 | 0.5959 |
| Q.2.M | 0.1345 | 0.3194 | 0.3607 | 0.2712 | 0.2035 | 0.2641 | 0.3928 | 0.5046 | 0.5539 | 0.4730 |
| Q.2.N | 0.2898 | 0.4170 | 0.3405 | 0.3533 | 0.3887 | 0.2751 | 0.3854 | 0.6685 | 0.7429 | 0.6685 |
| Q.4 | 0.1202 | 0.0363 | 0.0967 | 0.1340 | 0.0665 | -0.0258 | 0.0160 | 0.0473 | 0.1548 | -0.0133 |
| Q.7 | -0.1512 | -0.0243 | -0.0768 | -0.1550 | 0.0725 | -0.0150 | -0.0439 | 0.0959 | -0.0612 | -0.0633 |
| Q.8 | 0.0000 | 0.0020 | -0.0160 | -0.1190 | -0.0303 | -0.0185 | 0.0255 | -0.1016 | -0.0729 | -0.1235 |
| Q.9 | -0.0545 | 0.1045 | -0.1349 | -0.1077 | -0.1537 | -0.0343 | -0.1685 | -0.0136 | -0.0292 | -0.0380 |
| Q.10 | -0.0251 | 0.0268 | 0.0367 | 0.0574 | -0.0192 | -0.0417 | 0.0356 | 0.2415 | 0.2307 | 0.1668 |
| Q.11 | -0.0966 | -0.0420 | -0.0894 | 0.1545 | 0.0450 | 0.0389 | 0.0080 | 0.2134 | 0.1170 | 0.1099 |
| Q.12 | -0.0972 | -0.1189 | 0.0222 | -0.0145 | -0.0789 | -0.2401 | -0.0673 | -0.0208 | -0.0251 | -0.2091 |
| Q.13 | -0.0874 | -0.0505 | -0.0945 | -0.1179 | -0.1054 | 0.0532 | 0.0522 | 0.0529 | -0.0019 | -0.0543 |
| Q.14 | -0.1870 | -0.1263 | -0.0534 | -0.0667 | -0.2010 | 0.0649 | 0.1231 | -0.0912 | -0.1569 | -0.2095 |
| Q.15 | -0.1002 | -0.0720 | -0.0309 | -0.0338 | 0.0900 | 0.2285 | 0.2545 | 0.0146 | 0.0492 | 0.0038 |
| Q.21 | -0.0889 | -0.0086 | -0.0919 | -0.0665 | -0.0112 | -0.2348 | -0.2843 | 0.1809 | 0.1281 | 0.1112 |
| Q.22 | -0.1341 | -0.0420 | 0.1471 | 0.1202 | -0.0993 | -0.1226 | -0.0347 | 0.2043 | 0.1819 | 0.1036 |
| Q.23 | 0.0768 | 0.0828 | 0.0512 | 0.1213 | 0.1440 | -0.0284 | 0.0124 | -0.0459 | 0.0990 | 0.0842 |
| Q.24 | 0.0676 | 0.0222 | 0.0892 | -0.0334 | -0.0663 | 0.0005 | 0.0519 | -0.0189 | -0.0058 | -0.0072 |
| Q.33 | -0.0579 | -0.1045 | 0.0531 | 0.1095 | -0.1555 | -0.0199 | -0.0541 | 0.0317 | -0.0656 | -0.1271 |
| Q.34 | 0.2667 | 0.1663 | 0.1707 | 0.1844 | 0.1759 | 0.2198 | 0.2683 | 0.0753 | 0.0882 | 0.1530 |

¹ AC-55(Q21,Q23), AC-61(Q21), BC-26(Q23), BC-61(Q2h), BS-24(Q2h) and XX-01 (Q8)

Table 7c.4. Correlation table (Questions Q.2k.-Q11 to Q34)

| | | | | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|------------|------------|------------|------------|-------------|-------------|
| Q.2.K | Q.2.K | | | | | | | | | |
| Q.2.L | 0.6825 | Q.2.L | | | | | | | | |
| Q.2.M | 0.4507 | 0.6592 | Q.2.M | | | | | | | |
| Q.2.N | 0.5542 | 0.6630 | 0.5764 | Q.2.N | | | | | | |
| Q.4 | -0.0018 | 0.0871 | 0.0289 | 0.0992 | Q.4 | | | | | |
| Q.7 | -0.0670 | -0.0891 | 0.1153 | -0.0789 | -0.0901 | Q.7 | | | | |
| Q.8 | -0.0147 | -0.0871 | 0.0532 | -0.1415 | -0.1969 | 0.3807 | Q.8 | | | |
| Q.9 | -0.0735 | -0.0226 | -0.0185 | -0.0538 | -0.1101 | -0.1780 | -0.2574 | Q.9 | | |
| Q.10 | 0.2669 | 0.1767 | 0.0840 | 0.1333 | -0.1397 | -0.1548 | -0.0022 | 0.0665 | Q.10 | |
| Q.11 | 0.0484 | 0.1072 | 0.0481 | 0.0895 | -0.0320 | 0.1086 | -0.0235 | 0.0800 | 0.1673 | Q.11 |
| Q.12 | 0.0472 | -0.0061 | 0.0171 | -0.0208 | 0.0739 | -0.0222 | 0.0400 | -0.0087 | 0.0112 | -0.2214 |
| Q.13 | -0.0381 | -0.0174 | 0.0367 | 0.0770 | -0.0830 | -0.1045 | -0.0359 | 0.1822 | 0.2341 | 0.2412 |
| Q.14 | -0.0189 | -0.0847 | -0.0579 | -0.1109 | -0.0582 | 0.1424 | 0.3185 | -0.0094 | 0.0163 | -0.0211 |
| Q.15 | 0.0052 | 0.0869 | 0.1299 | 0.1050 | -0.1267 | -0.0257 | 0.1316 | 0.0965 | 0.2226 | 0.1262 |
| Q.21 | 0.0583 | -0.0452 | 0.0968 | 0.0426 | -0.1919 | 0.1118 | 0.0310 | 0.0339 | 0.1667 | 0.0849 |
| Q.22 | 0.1799 | 0.1648 | 0.1741 | 0.1423 | 0.0819 | 0.1191 | -0.0051 | 0.0580 | 0.1580 | 0.1557 |
| Q.23 | 0.0363 | 0.1777 | 0.1261 | 0.0653 | 0.1142 | -0.0624 | 0.0796 | 0.0342 | -0.0848 | 0.0538 |
| Q.24 | -0.0973 | 0.0308 | 0.0875 | 0.0853 | 0.0409 | 0.1030 | 0.0038 | -0.1124 | -0.0069 | 0.0606 |
| Q.33 | 0.0671 | -0.0422 | -0.1039 | -0.0909 | -0.1029 | -0.0490 | 0.0913 | 0.1417 | 0.1952 | 0.2267 |
| Q.34 | 0.0518 | 0.1098 | 0.0387 | 0.1531 | 0.0308 | -0.0804 | 0.0097 | -0.0523 | -0.0290 | -0.0212 |

Table 7c.5. Correlation table (Questions Q.12 to Q34)

| | | | | | | | | | | |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Q.12 | Q.12 | | | | | | | | | |
| Q.13 | -0.0762 | Q.13 | | | | | | | | |
| Q.14 | 0.1622 | 0.2097 | Q.14 | | | | | | | |
| Q.15 | 0.0346 | 0.4371 | 0.4806 | Q.15 | | | | | | |
| Q.21 | 0.1002 | 0.0083 | -0.1331 | -0.0091 | Q.21 | | | | | |
| Q.22 | 0.2033 | 0.1615 | 0.2221 | 0.0686 | 0.2661 | Q.22 | | | | |
| Q.23 | -0.0513 | -0.1308 | -0.2690 | -0.2093 | -0.0798 | -0.2356 | Q.23 | | | |
| Q.24 | 0.1496 | -0.0021 | -0.0041 | -0.0461 | 0.0026 | 0.0300 | 0.1065 | Q.24 | | |
| Q.33 | 0.0458 | 0.0615 | 0.1264 | 0.0021 | 0.0046 | 0.2115 | -0.0418 | -0.1819 | Q.33 | |
| Q.34 | -0.2241 | -0.1128 | -0.1347 | 0.1319 | -0.0488 | -0.1405 | 0.1623 | 0.0519 | -0.2074 | Q.34 |

A7C.3 FREQUENCY TABLES

A7C.3.1 Environment satisfaction parameters

Table 7c.6. Q2.a Frequency table: Temperature comfort

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|-----------------------|
| 1 (Poor) | 5 | 5% | Unsatisfactory 26% |
| 2 | 22 | 21% | |
| 3 | 45 | 43% | Satisfactory 74% |
| 4 (Good) | 33 | 31% | |
| Total | 105 | 100% | 100% |

Table 7c.7. Q2.b Frequency table: Ventilation comfort

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|-----------------------|
| 1 (Poor) | 7 | 7% | Unsatisfactory 27% |
| 2 | 21 | 20% | |
| 3 | 40 | 38% | Satisfactory 73% |
| 4 (Good) | 37 | 35% | |
| Total | 105 | 100% | 100% |

Table 7c.8. Q2.c Frequency table: Illumination comfort

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|-----------------------|
| 1 (Poor) | - | - | Unsatisfactory 18% |
| 2 | 19 | 18% | |
| 3 | 44 | 42% | Satisfactory 82% |
| 4 (Good) | 42 | 40% | |
| Total | 105 | 100% | 100% |

Table 7c.9. Q2.d Frequency table: Background noise level

| Scale | Frequency | % | Group % |
|------------------|------------|-------------|-----------------------|
| 1 (Noisy) | 7 | 7% | Unsatisfactory 34% |
| 2 | 29 | 28% | |
| 3 | 35 | 33% | Satisfactory 66% |
| 4 (Quiet) | 34 | 32% | |
| Total | 105 | 100% | 100% |

Table 7c.10. Q2.e Frequency table: Frequency of distractions

| Scale | Frequency | % | Group % |
|---------------------|------------|-------------|-----------------------|
| 1 (Frequent) | 6 | 6% | Unsatisfactory 34% |
| 2 | 30 | 29% | |
| 3 | 42 | 40% | Satisfactory 66% |
| 4 (Rare) | 27 | 26% | |
| Total | 105 | 100% | 100% |

Table 7c.11. Q2.f Frequency table: Visual privacy at workstation

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|-----------------------|
| 1 (Poor) | 20 | 19% | Unsatisfactory 36% |
| 2 | 18 | 17% | |
| 3 | 32 | 30% | Satisfactory 64% |
| 4 (Good) | 35 | 33% | |
| Total | 105 | 100% | 100% |

Table 7c.12. Q2.g Frequency table: Voice privacy at workstation

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|----------------|
| 1 (Poor) | 30 | 29% | Unsatisfactory |
| 2 | 27 | 26% | |
| 3 | 25 | 24% | Satisfactory |
| 4 (Good) | 23 | 22% | |
| Total | 105 | 100% | 100% |

Table 7c.13. Q2.h Frequency table: General spatial arrangement

| Scale | Frequency | Relative % | Group % |
|-----------------|----------------------------|-------------|----------------|
| 1 (Poor) | 1 | 1% | Unsatisfactory |
| 2 | 15 | 15% | |
| 3 | 42 | 41% | Satisfactory |
| 4 (Good) | 45 | 44% | |
| Total | 103 (2)² | 100% | 100% |

Table 7c.14. Q2.i Frequency table: General furniture arrangement

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|----------------|
| 1 (Poor) | 2 | 2% | Unsatisfactory |
| 2 | 14 | 13% | |
| 3 | 45 | 43% | Satisfactory |
| 4 (Good) | 44 | 42% | |
| Total | 105 | 100% | 100% |

Table 7c.15. Q2.j Frequency table: General office size

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|----------------|
| 1 (Poor) | 2 | 2% | Unsatisfactory |
| 2 | 9 | 9% | |
| 3 | 37 | 35% | Satisfactory |
| 4 (Good) | 57 | 54% | |
| Total | 105 | 100% | 100% |

Table 7c.16. Q2.k Frequency table: General office storage space

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|----------------|
| 1 (Poor) | 15 | 14% | Unsatisfactory |
| 2 | 23 | 22% | |
| 3 | 29 | 28% | Satisfactory |
| 4 (Good) | 38 | 36% | |
| Total | 105 | 100% | 100% |

Table 7c.17. Q2.l Frequency table: Individual storage space

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|----------------|
| 1 (Poor) | 10 | 10% | Unsatisfactory |
| 2 | 23 | 22% | |
| 3 | 33 | 31% | Satisfactory |
| 4 (Good) | 39 | 37% | |
| Total | 105 | 100% | 100% |

² This question registered 2 Non-Responses (from questionnaires BC-61 and BS-24). The total number of responses taken into account for this question is 103.

Table 7c.18. Q2.m Frequency table: Workspace available on workstation

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|-----------------------|
| 1 (Poor) | 1 | 1% | Unsatisfactory 14% |
| 2 | 14 | 13% | |
| 3 | 40 | 38% | Satisfactory 86% |
| 4 (Good) | 50 | 48% | |
| Total | 105 | 100% | 100% |

Table 7c.19. Q2.n Frequency table: Overall space environment satisfaction

| Scale | Frequency | % | Group % |
|-----------------|------------|-------------|-----------------------|
| 1 (Poor) | 1 | 1% | Unsatisfactory 12% |
| 2 | 12 | 11% | |
| 3 | 46 | 44% | Satisfactory 88% |
| 4 (Good) | 46 | 44% | |
| Total | 105 | 100% | 100% |

A7C.4 CROSS ANALYSIS TABLES

A7C.4.1 Office environment

Table 7c.20. [Q1 | C/S] Crossanalysis: Type of building by City/Suburb Group.

| Code | Type of Building | City | Suburb | Total |
|--------------|--|-----------|-----------|--------------|
| 1 | Adapted home / apartment unit | - | 8 | 8 |
| 2 | Adapted warehouse or other non-office building | 7 | 10 | 17 |
| 3 | Office building or building designed for the organisation's activities | 41 | 33 | 74(2) |
| Total | | 48 | 51 | 99(2) |

The total number of respondents for question Q1 is 101 (99+2). The remaining balance (2) is due to the two 'unknown' respondents (XX-01 and XX-02)

A7C.4.1a [Q1 | Q2] Crossanalysis: Type of building and Environmental parameters

Table 7c.21. [Q1 | Q2.a] Crossanalysis: Type of building and Temperature

| Scale | Adapted Space | | | Purpose designed | | | Total |
|-----------------|---------------|-------------|------------|------------------|-------------|------------|---------------|
| 1 (Poor) | 1 | 4% | 24% | 4 | 5% | 26% | 5 |
| 2 | 5 | 20% | | 16 | 21% | | 21(1) |
| 3 | 12 | 48% | 76% | 30 | 40% | 74% | 42(3) |
| 4 (Good) | 7 | 28% | | 26 | 34% | | 33 |
| Total | 25 | 100% | | 76 | 100% | | 101(4) |

Table 7c.22. [Q1 | Q2.b] Crossanalysis: Type of building and Ventilation comfort

| Scale | Adapted Space | | | Purpose designed | | | Total |
|-----------------|---------------|-------------|------------|------------------|-------------|------------|---------------|
| 1 (Poor) | - | - | 8% | 6 | 8% | 32% | 6(1) |
| 2 | 2 | 8% | | 18 | 24% | | 20(1) |
| 3 | 13 | 52% | 92% | 26 | 34% | 68% | 39(1) |
| 4 (Good) | 10 | 40% | | 26 | 34% | | 36(1) |
| Total | 25 | 100% | | 76 | 100% | | 101(4) |

Table 7c.23. [Q1|Q2.c] Crossanalysis: Type of building and Illumination comfort

| Scale | Adapted Space | | Purpose designed | | Total |
|-----------------|---------------|-------------|------------------|-------------|---------------|
| 1 (Poor) | - | - | 28% | - | - |
| 2 | 7 | 28% | | 11 | 18(1) |
| 3 | 8 | 32% | 72% | 34 | 42(2) |
| 4 (Good) | 10 | 40% | | 31 | 41(1) |
| Total | 25 | 100% | 76 | 100% | 101(4) |

Table 7c.24. [Q1|Q2.d] Crossanalysis: Type of building and background noise level

| Scale | Adapted Space | | Purpose designed | | Total |
|-----------------|---------------|-------------|------------------|-------------|---------------|
| 1 (Poor) | 2 | 8% | 40% | 5 | 7 |
| 2 | 8 | 32% | | 21 | 29 |
| 3 | 6 | 24% | 60% | 27 | 33(2) |
| 4 (Good) | 9 | 36% | | 23 | 32(2) |
| Total | 25 | 100% | 76 | 100% | 101(4) |

Table 7c.25. [Q1|Q2.e] Crossanalysis: Type of building and Frequency of distractions

| Scale | Adapted Space | | Purpose designed | | Total |
|-----------------|---------------|-------------|------------------|-------------|---------------|
| 1 (Poor) | 0 | 0% | 28% | 6 | 6 |
| 2 | 7 | 28% | | 23 | 30 |
| 3 | 9 | 36% | 72% | 30 | 39(3) |
| 4 (Good) | 9 | 36% | | 17 | 26(1) |
| Total | 25 | 100% | 76 | 100% | 101(4) |

Table 7c.26. [Q1|Q2.f] Crossanalysis: Type of building and Visual privacy at your workstation

| Scale | Adapted Space | | Purpose designed | | Total |
|-----------------|---------------|-------------|------------------|-------------|--------------|
| 1 (Poor) | 6 | 24% | 44% | 14 | 20 |
| 2 | 5 | 20% | | 13 | 18 |
| 3 | 3 | 12% | 56% | 28 | 31(1) |
| 4 (Good) | 11 | 44% | | 21 | 32(3) |
| Total | 25 | 100% | 76 | 100% | 101 |

Table 7c.27. [Q1|Q2.g] Crossanalysis: Type of building and Voice privacy at workstation

| Scale | Adapted Space | | Purpose designed | | Total |
|-----------------|---------------|-------------|------------------|-------------|---------------|
| 1 (Poor) | 8 | 32% | 56% | 21 | 29(1) |
| 2 | 6 | 24% | | 21 | 27 |
| 3 | 3 | 12% | 44% | 21 | 24(1) |
| 4 (Good) | 8 | 32% | | 13 | 21(2) |
| Total | 25 | 100% | 76 | 100% | 101(4) |

Table 7c.28. [Q1|Q2.h] Crossanalysis: Type of building and General spatial arrangement

| Scale | Adapted Space | | Purpose designed | | Total |
|-----------------|---------------|-------------|------------------|-------------|--------------|
| 1 (Poor) | 1 | 4% | 8% | - | 1 |
| 2 | 1 | 4% | | 13 | 14(1) |
| 3 | 7 | 29% | 92% | 34 | 41(1) |
| 4 (Good) | 15 | 63% | | 28 | 43(2) |
| Total | 24 | 100% | 75 | 100% | 99(4) |

Table 7c.29. [Q1|Q2.i] Crossanalysis: Type of building and General furniture arrangement

| Scale | Adapted Space | | Purpose designed | | | Total | |
|----------|---------------|------|------------------|------|-----|--------|-------|
| 1 (Poor) | 1 | 4% | 16% | - | - | 13% | 1(1) |
| 2 | 3 | 12% | | 10 | 13% | | 13(1) |
| 3 | 9 | 36% | 84% | 35 | 46% | 87% | 44(1) |
| 4 (Good) | 12 | 48% | | 31 | 41% | | 43(1) |
| Total | 25 | 100% | 76 | 100% | | 101(4) | |

Table 7c.30. [Q1|Q2.j] Crossanalysis: Type of building and General office size

| Scale | Adapted Space | | Purpose designed | | | Total | |
|----------|---------------|------|------------------|------|-----|-------|--------|
| 1 (Poor) | 1 | 4% | 8% | 1 | 2% | 11% | 2 |
| 2 | 1 | 4% | | 7 | 9% | | 8(1) |
| 3 | 7 | 28% | 92% | 29 | 38% | 89% | 36(1) |
| 4 (Good) | 16 | 64% | | 39 | 51% | | 55(2) |
| Total | 25 | 100% | 76 | 100% | | | 101(4) |

Table 7c.31. [Q1Q2.k] Crossanalysis: Type of building and General office storage space

| Scale | Adapted Space | | Purpose designed | | | Total | |
|----------|---------------|------|------------------|------|-----|--------|-------|
| 1 (Poor) | 3 | 12% | 32% | 11 | 15% | 36% | 14(1) |
| 2 | 5 | 20% | | 16 | 21% | | 21(2) |
| 3 | 8 | 32% | 68% | 20 | 26% | 64% | 28(1) |
| 4 (Good) | 9 | 36% | | 29 | 38% | | 38 |
| Total | 25 | 100% | 76 | 100% | | 101(4) | |

Table 7c.32. [Q1 | Q2.l] Crossanalysis: Type of building and Individual storage space

| Scale | Adapted Space | | | Purpose designed | | | Total |
|----------|---------------|------|-----|------------------|------|-----|--------|
| 1 (Poor) | 2 | 8% | 24% | 7 | 9% | 31% | 9(1) |
| 2 | 4 | 16% | | 17 | 22% | | 21(2) |
| 3 | 8 | 32% | 76% | 25 | 33% | 69% | 33 |
| 4 (Good) | 11 | 44% | | 27 | 36% | | 38(1) |
| Total | 25 | 100% | | 76 | 100% | | 101(4) |

Table 7c.33. [Q1|Q2.m] Crossanalysis: Type of building and Work space available on workstation

| Scale | Adapted Space | | Purpose designed | | | Total | |
|----------|---------------|------|------------------|------|-----|--------|-------|
| 1 (Poor) | - | - | 8% | 1 | 1% | 14% | 1 |
| 2 | 2 | 8% | | 10 | 13% | | 12(2) |
| 3 | 9 | 36% | 92% | 30 | 40% | 86% | 39(1) |
| 4 (Good) | 14 | 56% | | 35 | 46% | | 49(1) |
| Total | 25 | 100% | 76 | 100% | | 101(4) | |

Table 7c.34. [Q1|Q2.n] Crossanalysis: Type of building and Overall space environment satisfaction

| Scale | Adapted Space | | Purpose designed | | | Total | |
|----------|---------------|------|------------------|------|-----|-------|-----|
| 1 (Poor) | - | - | 8% | 1 | 1% | 13% | 1 |
| 2 | 2 | 8% | | 9 | 12% | | 11 |
| 3 | 9 | 36% | 92% | 35 | 46% | 87% | 44 |
| 4 (Good) | 14 | 56% | | 31 | 41% | | 45 |
| Total | 25 | 100% | 76 | 100% | | | 101 |

A7C.4.1b [Q3|Q2] Crossanalyses: Office layout and Environmental parameters

Table 7c.35. [Q3|Q2.a] Crossanalysis: Layout and Temperature comfort

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 1 | 3% | 23% | 4 | 7% | 32% | 5 |
| 2 | 8 | 20% | | 14 | 25% | | 22 |
| 3 | 17 | 43% | 78% | 23 | 40% | 68% | 40 |
| 4(Good) | 14 | 35% | | 16 | 28% | | 30 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.36. [Q3|Q2.b] Crossanalysis: Layout and Ventilation comfort

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 4 | 10% | 25% | 3 | 5% | 30% | 7 |
| 2 | 6 | 15% | | 14 | 25% | | 20 |
| 3 | 18 | 45% | 75% | 19 | 33% | 70% | 37 |
| 4(Good) | 12 | 30% | | 21 | 37% | | 33 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.37. [Q3|Q2.c] Crossanalysis: Layout and Illumination comfort

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 0 | 0% | 15% | 0 | 0% | 23% | 0 |
| 2 | 6 | 15% | | 13 | 23% | | 19 |
| 3 | 19 | 48% | 85% | 20 | 35% | 77% | 39 |
| 4(Good) | 15 | 38% | | 24 | 42% | | 39 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.38. [Q3|Q2.d] Crossanalysis: Layout and Background noise

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 3 | 8% | 40% | 4 | 7% | 32% | 7 |
| 2 | 13 | 33% | | 14 | 25% | | 27 |
| 3 | 9 | 23% | 60% | 23 | 40% | 68% | 32 |
| 4(Good) | 15 | 38% | | 16 | 28% | | 31 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.39. [Q3|Q2.e] Crossanalysis: Layout and Frequency of distractions

| Scale | Enclosed | | | Open Plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 4 | 10% | 35% | 2 | 4% | 35% | 6 |
| 2 | 10 | 25% | | 18 | 32% | | 28 |
| 3 | 17 | 43% | 65% | 22 | 39% | 65% | 39 |
| 4(Good) | 9 | 23% | | 15 | 26% | | 24 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.40. [Q3|Q2.f] Crossanalysis: Layout and Visual privacy

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 2 | 5% | 15% | 18 | 32% | 54% | 20 |
| 2 | 4 | 10% | | 13 | 23% | | 17 |
| 3 | 15 | 38% | 85% | 11 | 19% | 46% | 26 |
| 4(Good) | 19 | 48% | | 15 | 26% | | 34 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.41. [Q3|Q2.g] Crossanalysis: Layout and Voice privacy

| Scale | Enclosed | | | Open plan | | | Total |
|----------------|-----------|-------------|------------|-----------|-------------|------------|-----------|
| 1(Poor) | 5 | 13% | 30% | 25 | 44% | 74% | 30 |
| 2 | 7 | 18% | | 17 | 30% | | 24 |
| 3 | 16 | 40% | 70% | 6 | 11% | 26% | 22 |
| 4(Good) | 12 | 30% | | 9 | 16% | | 21 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.42. [Q3|Q2.h] Crossanalysis: Layout and General spatial arrangement

| Scale | Enclosed | | | Open plan | | | Total |
|----------------|-----------|-------------|------------|-----------|-------------|------------|--------------|
| 1(Poor) | 1 | 3% | 10% | 0 | 0% | 21% | 1 |
| 2 | 3 | 8% | | 12 | 21% | | 15 |
| 3 | 18 | 46% | 90% | 20 | 36% | 79% | 38 |
| 4(Good) | 17 | 44% | | 24 | 43% | | 41 |
| Total | 39 | 100% | | 56 | 100% | | 95(2) |

Table 7c.43. [Q3|Q2.i] Crossanalysis: Layout and General furniture arrangement

| Scale | Enclosed | | | Open plan | | | Total |
|----------------|-----------|-------------|------------|-----------|-------------|------------|-----------|
| 1(Poor) | 1 | 3% | 15% | 1 | 2% | 18% | 2 |
| 2 | 5 | 13% | | 9 | 16% | | 14 |
| 3 | 17 | 43% | 85% | 23 | 40% | 82% | 40 |
| 4(Good) | 17 | 43% | | 24 | 42% | | 41 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.44. [Q3|Q2.j] Crossanalysis: Layout and General office size

| Scale | Enclosed | | | Open plan | | | Total |
|----------------|-----------|-------------|------------|-----------|-------------|------------|-----------|
| 1(Poor) | 2 | 5% | 13% | 0 | 0% | 11% | 2 |
| 2 | 3 | 8% | | 6 | 11% | | 9 |
| 3 | 13 | 33% | 88% | 21 | 37% | 89% | 34 |
| 4(Good) | 22 | 55% | | 30 | 53% | | 52 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.45. [Q3|Q2.k] Crossanalysis: Layout and General office storage space

| Scale | Enclosed | | | Open plan | | | Total |
|----------------|-----------|-------------|------------|-----------|-------------|------------|-----------|
| 1(Poor) | 5 | 13% | 38% | 10 | 18% | 39% | 15 |
| 2 | 10 | 25% | | 12 | 21% | | 22 |
| 3 | 11 | 28% | 63% | 15 | 26% | 61% | 26 |
| 4(Good) | 14 | 35% | | 20 | 35% | | 34 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.46. [Q3|Q2.l] Crossanalysis: Layout and Individual storage space

| Scale | Enclosed | | | Open plan | | | Total |
|----------------|-----------|-------------|-------------|-----------|-------------|-------------|-----------|
| 1(Poor) | 2 | 5% | 35% | 8 | 14% | 33% | 10 |
| 2 | 12 | 30% | | 11 | 19% | | 23 |
| 3 | 8 | 20% | 65% | 20 | 35% | 67% | 28 |
| 4(Good) | 18 | 45% | | 18 | 32% | | 36 |
| Total | 40 | 100% | 100% | 57 | 100% | 100% | 97 |

Table 7c.47. [Q3|Q2.m] Crossanalysis: Layout and Workspace available on workstation

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 0 | 0% | 15% | 1 | 2% | 16% | 1 |
| 2 | 6 | 15% | | 8 | 14% | | 14 |
| 3 | 12 | 30% | 85% | 23 | 40% | 84% | 35 |
| 4(Good) | 22 | 55% | | 25 | 44% | | 47 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

Table 7c.48. [Q3|Q2.n] Crossanalysis: Layout and Overall space environment satisfaction

| Scale | Enclosed | | | Open plan | | | Total |
|---------|----------|------|-----|-----------|------|-----|-------|
| 1(Poor) | 1 | 3% | 13% | 0 | 0% | 14% | 1 |
| 2 | 4 | 10% | | 8 | 14% | | 12 |
| 3 | 17 | 43% | 88% | 25 | 44% | 86% | 42 |
| 4(Good) | 18 | 45% | | 24 | 42% | | 42 |
| Total | 40 | 100% | | 57 | 100% | | 97 |

A7C.4.2 Work habits

A7C.4.2a Work/life balance satisfaction

Table 7c.49. [Q13|Q16] Crossanalysis: Work/life balance satisfaction by working hours per week

| Range | Frequency | | | Percentage | | |
|-----------------|-----------|----|-------|-----------------|------------------|-------|
| | Yes | No | Total | Satisfied (Yes) | Unsatisfied (No) | Total |
| 7.5 | 1 | - | 1 | 100% | 0% | 100% |
| 7.6 to 15 | 1 | - | 1 | 100% | 0% | 100% |
| 16 to 20 | - | - | - | - | - | - |
| 21 to 37.4 | 6 | 3 | 9 | 67% | 33% | 100% |
| 37.5 (standard) | 3 | 1 | 4 | 75% | 25% | 100% |
| 37.6 to 40 | 29 | 5 | 34 | 85% | 15% | 100% |
| 41 to 45 | 5 | 1 | 6 | 83% | 17% | 100% |
| 46 to 50 | 17 | 11 | 28 | 61% | 39% | 100% |
| 51 to 55 | 3 | - | 3 | 100% | 0% | 100% |
| 55 to 60 | 6 | 5 | 11 | 55% | 45% | 100% |
| 61 to 65 | - | 1 | 1 | - | 100% | 100% |
| 66 to 70 | 1 | 1 | 2 | 50% | 50% | 100% |
| 71 to 75 | 2 | - | 2 | 100% | 0% | 100% |
| 76 to 80 | - | 1 | 1 | - | 100% | 100% |
| Total | 74 | 29 | 103 | n/a | n/a | n/a |

Table 7c.50. [Q14|Q16] Crossanalysis: Work/life balance satisfaction by frequency of taking work home

| Scale | Frequency | | | Percentage | | |
|--------------------|-----------|----|-------|------------|-----|-------|
| | Yes | No | Total | Yes | No | Total |
| 1 (Never) | 19 | 5 | 24 | 79% | 21% | 100% |
| 2 | 31 | 11 | 42 | 74% | 26% | 100% |
| 3 | 17 | 6 | 23 | 74% | 26% | 100% |
| 4 (Every day) | 3 | 7 | 10 | 30% | 70% | 100% |
| 5 (Work from home) | 4 | 0 | 4 | 100% | 0% | 100% |
| Total | 70 | 29 | 103 | n/a | n/a | n/a |

Table 7c.51. [Q15|Q16] Crossanalysis: Work/life balance satisfaction by frequency of working on weekends

| Scale | Frequency | | | Percentage | | |
|--------------------------|-----------|-----------|------------|------------|------------|------------|
| | Yes | No | Total | Yes | No | Total |
| 1 (Never) | 23 | 4 | 27 | 85% | 15% | 100% |
| 2 | 36 | 13 | 49 | 73% | 27% | 100% |
| 3 | 14 | 7 | 21 | 67% | 33% | 100% |
| 4 (Every weekend) | 1 | 5 | 6 | 17% | 83% | 100% |
| Total | 74 | 29 | 103 | n/a | n/a | n/a |

Table 7c.52. [Q4=1|A/B|SM/O|Q36|Q13|Q5] Crossanalysis: Respondent with low workstation occupancy.

| ID | Profession Group | Position sub-group | Detailed Position (Q36) | Working hours per week (Q13) | Work mode ³ (Q5) | | |
|--------------|------------------|------------------------|-------------------------|------------------------------|-----------------------------|--------------|------------------------|
| | | | | | Indiv. work | Face to face | Building Relationships |
| AC-55 | Designer | Senior Management (SM) | Manager | 38 | - | - | 100% |
| AC-58 | Designer | | Director | 50 | 50% | 30% | 20% |
| BC-60 | Accountant | | Manager | 42 | 35% | 50% | 15% |
| BS-02 | Accountant | | Director | 50 | 50% | 40% | 10% |
| BS-21 | Accountant | | Partner | 50 | 80% | 20% | - |
| BS-30 | Accountant | | Director | 40 | 25% | 50% | 25% |

Table 7c.53. [Q5a|A/B|SM/O] Crossanalysis: Percentage of time spend in Individual work and quiet thinking by Profession and Position

| Range | Group A | | Group B | | Total |
|--------------------------|-------------|-------------|-------------|-------------|---------------|
| | A:SM | A:O | B:SM | B:O | |
| 90-100 | 8% | 12% | 9% | 17% | 10 |
| 80-89 | 32% | 13% | 22% | 8% | 24(1) |
| 70-79 | 15% | 25% | 9% | 25% | 15 |
| 60-69 | 13% | 25% | 20% | 17% | 18 |
| 50-59 | 5% | 13% | 11% | 25% | 11(1) |
| 40-49 | 5% | 12% | - | - | 3 |
| 30-39 | 11% | - | 16% | - | 11 |
| 20-29 | 5% | - | 11% | 8% | 8 |
| 10-19 | 3% | - | 2% | - | 2 |
| 1-9 | - | - | - | - | - |
| 0 | 3% | - | - | - | 1 |
| Total (%) | 100% | 100% | 100% | 100% | n/a |
| Total (Frequency) | 38 | 8 | 45 | 12 | 103(2) |

³ Approximate percentage of time spend in such working mode.

Table 7c.54. [Q5b|A/B|SM/O] Crossanalysis: Percentage of time spend in Face-to-Face collaboration by Profession and Position

| Range | Group A | | Group B | | Total |
|-------------------|---------|------|---------|------|--------|
| | A:SM | A:O | B:SM | B:O | |
| 90-100 | - | - | - | - | - |
| 80-89 | - | - | - | - | - |
| 70-79 | - | - | - | - | - |
| 60-69 | 3% | - | 4% | - | 3 |
| 50-59 | 5% | - | 11% | - | 7 |
| 40-49 | 3% | - | 13% | 25% | 10 |
| 30-39 | 11% | 37% | 17% | 17% | 16 |
| 20-29 | 29% | 25% | 27% | 25% | 28(2) |
| 10-19 | 38% | 25% | 24% | 17% | 30 |
| 1-9 | 8% | 13% | 4% | 8% | 7 |
| 0 | 3% | - | - | 8% | 2 |
| Total (%) | 100% | 100% | 100% | 100% | n/a |
| Total (Frequency) | 38 | 8 | 45 | 12 | 103(2) |

Table 7c.55. [Q5c|A/B|SM/O] Crossanalysis: Percentage of time spend Building relationships and socialising by Profession and Position

| Range | Group A | | Group B | | Total |
|-------------------|---------|------|---------|------|-------|
| | A:SM | A:O | B:SM | B:O | |
| 90-100 | 3% | - | - | - | 1 |
| 80-89 | - | - | - | - | - |
| 70-79 | - | - | - | - | - |
| 60-69 | 8% | - | - | - | 3 |
| 50-59 | 5% | - | - | - | 2 |
| 40-49 | - | - | 9% | 8% | 5 |
| 30-39 | - | 13% | 11% | - | 6 |
| 20-29 | 18% | 38% | 16% | 25% | 20 |
| 10-19 | 29% | 13% | 29% | 25% | 28 |
| 1-9 | 32% | 38% | 29% | 25% | 31 |
| 0 | 5% | - | 7% | 17% | 7 |
| Total (%) | 100% | 100% | 100% | 100% | n/a |
| Total (Frequency) | 38 | 8 | 45 | 12 | 103 |

Table 7c.56. [Q9|A/B|SM/O] Crossanalysis: Face-to-face collaboration by Profession and Position

| Scale | Group A | | | | Group B | | | |
|------------------|---------|------|-----|------|---------|------|-----|------|
| | A:SM | | A:O | | B:SM | | B:O | |
| 1 (Not required) | 5 | 13% | - | - | 1 | 2% | 1 | 8% |
| 2 | 3 | 8% | 3 | 38% | 13 | 29% | 3 | 25% |
| 3 | 17 | 45% | 5 | 63% | 16 | 36% | 4 | 33% |
| 4 (Essential) | 13 | 34% | - | - | 15 | 33% | 4 | 33% |
| Total | 38 | 100% | 8 | 100% | 45 | 100% | 12 | 100% |

Table 7c.57. [Q9=1|Q33|Q36|Q5|Q1|Q29|Q31] Crossanalysis: Low face-to-face collaboration analysis

| ID | Q33. No. of employees | Q36 Positi on | Q5 Working modes | Q1 Type of building | Q29 Teleworking | Q31 Travel time |
|-------|------------------------------|---------------------|------------------------|---|--|-----------------------|
| AS-07 | 1-10 | SM | 90 5 5 | Adapted home/Apartment unit | I work from home all days a week | - |
| AS-10 | 100-150 | SM | 80 10 10 | Adapted home/Apartment unit | I work from home 3 days a week | 1 hr |
| AS-46 | 1-10 | SM | 80 10 15 | Adapted home/Apartment unit | I work from home 4 days a week | 2 hrs |
| AS-48 | 21-40 | SM | 70 10 20 | Office building or building designed for the organisation's activities | Do not use this option, rather go to the office | 1 hr |
| AS-71 | 1-10 | SM | 40 20 20 (20) | Office building or building designed for the organisation's activities | Work from home 1 day a week | 10 min |
| BC-37 | 1-10 | O | 100 - - | Office building or building designed for the organisation's activities | Don't use this option, rather go to the office | 1 hr |
| BS-24 | 1-10 Sole practitioner | SM | 60 30 10 | Adapted home/Apartment unit | I work from home 5 days a week | - |
| BS-66 | 1-10 | SM | 94 5 1 | Office building or building designed for the organisation's activities | Rather go to the office | 45 min |

Table 7c.58. [Q17|A/B|SM/O] Crossanalysis: type of computer by Profession and Position

| Code | Description | Group A | | | | Group B | | | | Total |
|-------|--------------------------|---------|------|-----|------|---------|------|-----|------|--------|
| | | A:SM | | A:O | | B:SM | | B:O | | |
| 1 | Desktop / non-portable | 22 | 58% | 7 | 88% | 28 | 62% | 6 | 50% | 63(1) |
| 2 | Laptop/portable | 13 | 34% | 1 | 13% | 15 | 33% | 4 | 33% | 33(1) |
| 3 | I do not have a computer | - | - | - | - | - | - | - | - | - |
| 4 | Desktop & Laptop | 3 | 8% | - | - | 2 | 4% | 2 | 17% | 7 |
| Total | | 38 | 100% | 8 | 100% | 45 | 100% | 12 | 100% | 103(2) |

Table 7c.59. [Q12=1|Q34|Q36|Q33|Q28|Q17|Q18|Q19|Q21|Q22|Q23] Crossanalysis: Respondents with no dependency on computers to their work

| Code | Q34 Age group | Q36 Position | Q33 No. Of employees | Q28 Computer at home | Q17 Computer at work | Q18 Internet | Q19 Website | Q21 Monitors | Q22 Adopter | Q23 Emails-vs.-fax |
|-------|---------------|--------------|----------------------|----------------------|----------------------|--------------|-------------|--------------|-------------|--------------------|
| AS-18 | 30 | SM | 1-10 | Yes | Desktop | B'band | Yes | 4 | 4 | 2 |
| BS-30 | 60 | SM | 1-10 | No | Desktop | B'band | No | 4 | 2 | 1 |
| BS-64 | 50 | SM | 21-40 | Yes | Desktop | B'band | Yes | 3 | 2 | 1 |

A7C.4.3 Organisational context

Table 7c.60. [Q07|A/B|Q33] Crossanalysis: Time flexibility by profession and size of company

| Scale | Group A | | | | Group B | | | |
|-----------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 (Low) | 7 | 23% | 3 | 20% | 7 | 24% | 5 | 18% |
| 2 | 3 | 10% | 6 | 40% | 6 | 21% | 10 | 36% |
| 3 | 10 | 32% | 5 | 33% | 10 | 34% | 12 | 43% |
| 4 (High) | 11 | 35% | 1 | 7% | 6 | 21% | 1 | 4% |
| Total | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

- Group A: $(10+11+5+1)/(31+15)$
- Group B: $(10+6+12+1)/(29+28)$

Table 7c.61. [Q08|A/B|Q33] Crossanalysis: Place flexibility by profession and size of company

| Scale | Group A | | | | Group B | | | |
|-----------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 (Low) | 15 | 48% | 5 | 33% | 11 | 38% | 7 | 25% |
| 2 | 9 | 29% | 8 | 53% | 8 | 28% | 13 | 46% |
| 3 | 5 | 16% | 1 | 7% | 3 | 10% | 8 | 29% |
| 4 (High) | 2 | 6% | 1 | 7% | 7 | 24% | - | - |
| Total | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

- for Group A, scale 1: $(15+5)/(31+15)$
- for Group B, scale 1: $(11+7)/(29+28)$
- for Group A, scales 1 and 2: $(15+9+5+8)/(31+15)$
- for Group B, scales 1 and 2: $(11+8+7+13)/(29+28)$
- for Group 1-10 employees, scales 1 and 2: $(15+9+11+8)/(31+29)$
- for Group 11+ employees, scales 1 and 2: $(5+8+7+13)/(15+28)$

Table 7c.62. [Q10|A/B|Q33] Crossanalysis: Bureaucracy level by profession and size of company

| Scale | Group A | | | | Group B | | | |
|-----------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 (Low) | 9 | 29% | 3 | 20% | 12 | 41% | 3 | 11% |
| 2 | 11 | 35% | 5 | 33% | 7 | 24% | 13 | 46% |
| 3 | 10 | 32% | 4 | 27% | 8 | 28% | 9 | 32% |
| 4 (High) | 1 | 3% | 3 | 20% | 2 | 7% | 3 | 11% |
| Total | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

- for Group 1-10 employees, scales 1 and 2: $(9+11+12+7)/(31+29)$
- for Group 11+, scales 1 and 2: $(3+5+3+13)/(15+28)$
- for Group A, scale 1: $(9+3)/(31+15)$
- for Group B, scale 1: $(12+3)/(29+28)$
- for Group A, scales 1 and 2: $(9+11+3+5)/(31+15)$
- for Group B, scales 1 and 2: $(12+7+3+13)/(29+28)$

Table 7c.63. [Q11|A/B|Q33] Crossanalysis: Level of interpersonal competitiveness by profession and size of company

| Scale | Group A | | | | Group B | | | |
|-----------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 (Low) | 11 | 35% | 4 | 27% | 12 | 41% | 4 | 14% |
| 2 | 9 | 29% | 7 | 47% | 11 | 38% | 16 | 57% |
| 3 | 9 | 29% | 3 | 20% | 4 | 14% | 8 | 29% |
| 4 (High) | 2 | 6% | 1 | 7% | 2 | 7% | - | - |
| Total | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

- for Group 1-10, scales 1 and 2: $(11+9+12+11)/(31+29)$
- for Group 11+, scales 1 and 2: $(4+7+4+16)/(15+28)$
- for Group A, scale 1: $(11+4)/(31+15)$
- for Group B, scale 1: $(12+4)/(29+28)$
- for Group B, scales 1 and 2: $(12+11+4+16)/(29+28)$
- for Group A, scales 1 and 2: $(11+9+4+7)/(31+15)$

Table 7c.64. [Q26a|A/B|Q33]a Crossanalysis: Electricity policy by Profession and Company size

| Code | Description | Group A | | | | Group B | | | |
|--------------|---------------------------------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 | Yes | 10 | 32% | 7 | 47% | 4 | 14% | 6 | 21% |
| 2 | Yes, but not properly followed | 4 | 13% | 4 | 27% | 4 | 14% | 7 | 25% |
| 3 | No | 17 | 55% | 4 | 27% | 21 | 72% | 15 | 54% |
| Total | | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

Table 7c.65. [Q26a|A/B|Q33]b Crossanalysis: Electricity policy by Profession and Company size (percentages by Groups)

| | Yes | Yes, but.. | Have policy | No | Total |
|-------------------|-----|------------|-------------|-----|-------------|
| Group A | 37% | 17% | 54% | 46% | 100% |
| Group B | 18% | 19% | 37% | 63% | 100% |
| Group 1-10 | 24% | 13% | 37% | 63% | 100% |
| Group 11+ | 30% | 26% | 56% | 44% | 100% |

Table 7c.66. [Q26b|A/B|Q33]a Crossanalysis: Water policy by Profession and Company size

| Code | Description | Group A | | | | Group B | | | |
|--------------|---------------------------------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
| | | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 | Yes | 11 | 35% | 7 | 47% | 5 | 17% | 1 | 4% |
| 2 | Yes, but not properly followed | 2 | 6% | 3 | 20% | 3 | 10% | 4 | 14% |
| 3 | No | 18 | 58% | 5 | 33% | 21 | 72% | 23 | 82% |
| Total | | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

Table 7c.67. [Q26b|A/B|Q33]b Crossanalysis: Water policy by Profession and Company size (percentages by Groups)

| | Yes | Yes, but.. | Have policy | No | Total |
|-------------------|-----|------------|-------------|-----|-------------|
| Group A | 39% | 11% | 50% | 50% | 100% |
| Group B | 11% | 12% | 23% | 77% | 100% |
| Group 1-10 | 27% | 8% | 35% | 65% | 100% |
| Group 11+ | 19% | 16% | 35% | 65% | 100% |

Table 7c.68. [Q26c|A/B|Q33]a Crossanalysis: Paper policy by Profession and Company size

| Code | Description | Group A | | | | Group B | | | |
|-------|--------------------------------|---------|------|-----|------|---------|------|-----|------|
| | | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 | Yes | 13 | 42% | 10 | 67% | 10 | 34% | 8 | 29% |
| 2 | Yes, but not properly followed | 8 | 26% | 3 | 20% | 9 | 31% | 13 | 46% |
| 3 | No | 10 | 32% | 2 | 13% | 10 | 34% | 7 | 25% |
| Total | | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

Table 7c.69. [Q26c|A/B|Q33]b Crossanalysis: Paper policy by Profession and Company size (percentages by Groups)

| | Yes | Yes, but.. | Have policy | No | Total |
|------------|-----|------------|-------------|-----|-------|
| Group A | 50% | 24% | 74% | 26% | 100% |
| Group B | 32% | 38% | 70% | 30% | 100% |
| Group 1-10 | 38% | 29% | 67% | 33% | 100% |
| Group 11+ | 42% | 37% | 79% | 21% | 100% |

Table 7c.70. [Q26d|A/B|Q33]a Crossanalysis: Car policy by Profession and Company size

| Code | Description | Group A | | | | Group B | | | |
|-------|--------------------------------|---------|------|-----|------|---------|------|-----|------|
| | | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 | Yes | 9 | 29% | 7 | 47% | 3 | 10% | 1 | 4% |
| 2 | Yes, but not properly followed | 2 | 6% | 2 | 13% | 4 | 14% | 2 | 7% |
| 3 | No | 20 | 65% | 6 | 40% | 22 | 76% | 25 | 89% |
| Total | | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

Table 7c.71. [Q26d|A/B|Q33]b Crossanalysis: Car policy by Profession and Company size (percentages by Groups)

| | Yes | Yes, but.. | Have policy | No | Total |
|------------|-----|------------|-------------|-----|-------|
| Group A | 34% | 9% | 43% | 57% | 100% |
| Group B | 7% | 11% | 18% | 82% | 100% |
| Group 1-10 | 20% | 10% | 30% | 70% | 100% |
| Group 11+ | 19% | 9% | 28% | 72% | 100% |

A7C.4.4 Technology

Table 7c.72. Cross analysis: [Q18=1:Q19:Q20:Q21:Q22:Q23:Q33]: Respondents with Dialup connection

| ID | Q19 Website | Q20 Wireless network | Q21 Monitor | Q22 Adopter | Q23 email vs. fax | Q33 Employees |
|-------|----------------|----------------------------|----------------|----------------|----------------------|------------------|
| AC-32 | Yes | No | 3 | 3 | Email (1) | 1-10 |
| AC-53 | Yes | No | 4 | 3 | Email (1) | 1:10 |
| AS-10 | Yes | Yes | 4 | 4 | Email (1) | 100-150 |
| BC-26 | No | No | 1 | 1 | Uses both | 1-10 |
| BS-10 | No | No | 4 | 3 | Email (1) | 1-10 |

Table 7c.73. [Q19|A/B|Q33] Crossanalysis: Companies with/without website by profession and size of company

| Code | Description | Group A | | | | Group B | | | |
|-------|-------------|---------|------|-----|------|---------|------|-----|------|
| | | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 | Yes | 27 | 87% | 15 | 100% | 10 | 34% | 26 | 93% |
| 2 | No | 4 | 13% | - | - | 19 | 66% | 2 | 7% |
| Total | | 31 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

- for Group A, yes: $(27+15)/(31+15)$
- for Group B, yes: $(10+26)/(29+28)$
- for Group 11+, yes: $(15+26)/(15+28)$
- for Group 1-10, yes: $(27+10)/(31+29)$

Table 7c.74. [Q20|A/B|Q33] Crossanalysis: Companies with/without wireless network by profession and size of company

| Code | Description | Group A | | | | Group B | | | |
|-------|-------------|---------|------|-----|------|---------|------|-----|------|
| | | 1-10 | | 11+ | | 1-10 | | 11+ | |
| 1 | Yes | 11 | 37% | 8 | 53% | 13 | 45% | 14 | 50% |
| 2 | No | 19 | 63% | 7 | 47% | 16 | 55% | 14 | 50% |
| Total | | 30 | 100% | 15 | 100% | 29 | 100% | 28 | 100% |

- for Group B, yes: $(13+14)/(29+28)$
- for Group A, yes: $(11+8)/(30+15)$
- for Group 11+, yes: $(8+14)/(15+28)$
- for Group 1-10, yes: $(11+13)/(30+29)$

Table 7c.75. Crossanalysis: [Q21=1:Q18:Q19:Q20:Q22:Q23:Q33]: Respondents with only CRT monitors

| ID | Q18 Internet connection | Q19 Website | Q20 Wireless network | Q22 Adopter | Q23 email vs. fax | Q33 Employees |
|-------|-------------------------------|----------------|----------------------------|----------------|----------------------|------------------|
| AS-05 | Broadband | Yes | Yes | 3 | 1 | 1-10 |
| AS-38 | Broadband | Yes | Yes | 2 | 1 | 1-10 |
| AS-46 | Broadband | Yes | No | 3 | 1 | 1-10 |
| BC-26 | Dial-up | No | No | 1 | Use both | 1-10 |
| BC-45 | Broadband | No | No | 3 | 1 | 11-20 |
| BS-11 | Broadband | No | No | 1 | 3 | 1-10 |
| BS-59 | Broadband | No | No | 2 | 1 | 1-10 |

Table 7c.76. [Q24|A/B|Q33] Crossanalysis: Frequency of printing emails by Profession and Company Size

| | Frequently | | Rarely | | Total | |
|------------|------------|-----|--------|-----|-------|------|
| Group A | 15 | 33% | 31 | 67% | 46 | 100% |
| Group B | 22 | 39% | 35 | 61% | 57 | 100% |
| Group 1-10 | 19 | 32% | 41 | 68% | 60 | 100% |
| Group 11+ | 18 | 42% | 25 | 58% | 43 | 100% |

Table 7c.77. [Q25|A/B|Q33] Crossanalysis: Scanning of documents by Profession and Company Size

| | Yes | | No | | Total | |
|-------------------|-----|-----|----|-----|-------|------|
| Group A | 23 | 51% | 22 | 49% | 45 | 100% |
| Group B | 32 | 57% | 24 | 43% | 56 | 100% |
| Group 1-10 | 24 | 41% | 34 | 59% | 58 | 100% |
| Group 11+ | 31 | 72% | 12 | 28% | 43 | 100% |

Table 7c.78. [Q22|A/B]: Adopter type by Profession

| Scale | Group A | | Group B | |
|----------------------|-----------|-------------|-----------|-------------|
| 1 (Laggard) | 1 | 1% | 3 | 5% |
| 2 | 4 | 9% | 13 | 23% |
| 3 | 16 | 35% | 17 | 30% |
| 4 | 16 | 35% | 21 | 37% |
| 5 (Innovator) | 9 | 20% | 3 | 5% |
| Total | 46 | 100% | 57 | 100% |

Table 7c.79. [Q22|Q33] Adopter type by Size of company

| Scale | Small | | Large | |
|---------------------------|-----------|-------------|-----------|-------------|
| 1 (Laggard) | 4 | 7% | - | - |
| 2 (Late Majority) | 12 | 20% | 5 | 11% |
| 3 (Early Majority) | 24 | 40% | 9 | 20% |
| 4 (Early Adopter) | 13 | 22% | 26 | 58% |
| 5 (Innovator) | 7 | 11% | 5 | 11% |
| Total | 60 | 100% | 45 | 100% |

Table 7c.80. Crossanalysis: [Q22=1:Q17:Q18:Q19:Q20:Q21:Q23:Q33]: Adopter type: Laggards

| ID | Q17 Type of computer | Q18 Internet connection | Q19 Website | Q20 Wireless network | Q21 Monitor | Q23 email vs. fax | Q33 Employees |
|--------------|----------------------------|-------------------------------|----------------|----------------------------|----------------|----------------------|------------------|
| AS-62 | Laptop | Broadband | Yes | No | 4 | 1 | 1-10 |
| BC-26 | Desktop | Dial-up | No | No | 1 | Use both | 1-10 |
| BS-11 | Desktop | Broadband | No | No | 1 | 3 | 1-10 |
| BS-42 | Laptop | Broadband | No | No | 4 | 2 | 1-10 |

Table 7c.81. Crossanalysis: [Q22=5:Q17:Q18:Q19:Q20:Q21:Q23:Q33]: Adopter type: Innovators

| ID | Q17 Type of computer | Q18 Internet connection | Q19 Website | Q20 Wireless network | Q21 Monitor | Q23 email vs. fax | Q33 Employees |
|--------------|----------------------------|-------------------------------|----------------|----------------------------|----------------|----------------------|------------------|
| AC-08 | Desktop | Broadband | Yes | Yes | 4 | 1 | 1-10 |
| AC-09 | Laptop | Wireless | Yes | Yes | 4 | 1 | 11-20 |
| AC-25 | Desktop | Broadband | Yes | No | 4 | 1 | 11-20 |
| AC-50 | Laptop | Wireless | Yes | Yes | 4 | 1 | 1-10 |
| AC-59 | Desktop | Broadband | Yes | No | 4 | 1 | 1-10 |
| AC-61 | Desktop | Wireless | No | Yes | NR | 1 | 1-10 |
| AS-37 | Laptop | Wireless | Yes | Yes | 4 | 1 | 21-40 |
| AS-48 | Desktop | Wireless | Yes | Yes | 4 | 1 | 21-40 |
| AS-71 | Desktop | Wireless | Yes | Yes | 4 | 1 | 1-10 |
| BC-08 | Desktop | Broadband | Yes | Yes | 4 | 1 | 100-150 |
| BC-52 | Desktop | Broadband | Yes | Yes | 4 | 2 | 1-10 |
| BC-68 | Desktop | Wireless | No | Yes | 4 | 1 | 1-10 |

Table 7c.82. [Q22|Q21]a Crossanalysis: Adopter type by type of monitor

| Scale | | Q22 | | | | | | | | | |
|-------|----------------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q21 | 1 (CRT) | 2 | 50% | 2 | 12% | 3 | 9% | - | - | - | - |
| | 2 | - | - | 3 | 18% | 4 | 12% | 6 | 16% | - | - |
| | 3 | - | - | 3 | 18% | 5 | 15% | 6 | 16% | - | - |
| | 4 (Flat Panel) | 2 | 50% | 9 | 53% | 21 | 64% | 26 | 68% | 11 | 100% |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 38 | 100% | 11 | 100% |

Table 7c.83. [Q22|Q21]b Crossanalysis: Adopter type by type of monitor (Calculated type of monitor)

| Scale | | Factor | Q22 | | | | |
|------------------------|--------------|--------|-------------|------|------|------|---------------|
| | | | 1 (Laggard) | 2 | 3 | 4 | 5 (Innovator) |
| Q21 | 1 CRT | 1 | 0.50 | 0.12 | 0.09 | 0.00 | 0.00 |
| | 2 | 2 | 0.00 | 0.35 | 0.24 | 0.32 | 0.00 |
| | 3 | 3 | 0.00 | 0.53 | 0.45 | 0.47 | 0.00 |
| | 4 Flat Panel | 4 | 2.00 | 2.12 | 2.55 | 2.74 | 4.00 |
| Calculated flexibility | | | 2.50 | 3.12 | 3.33 | 3.53 | 4.00 |

In order to calculate the 'type of monitor' of each adopter, the relative frequency (percentage) from Table [Q22|Q21]a of each adopter type was multiplied by a factor relative to the scale. Then, by adding up the products the representative type of monitor by type of adopter is obtained.

Table 7c.84. [Q22|Q19] Crossanalysis: Adopter type by company having a web page

| (Code)Description | | Q22 | | | | | | | | | |
|-------------------|---------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q19 | (1) Yes | 1 | 25% | 9 | 53% | 24 | 73% | 35 | 90% | 10 | 83% |
| | (2) No | 3 | 75% | 8 | 47% | 9 | 27% | 4 | 10% | 2 | 17% |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 39 | 100% | 12 | 100% |

Table 7c.85. [Q22|Q20] Crossanalysis: Adopter type by company having a wireless network

| (Code)Description | | Q22 | | | | | | | | | |
|-------------------|---------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q20 | (1) Yes | - | - | 6 | 35% | 11 | 34% | 20 | 51% | 10 | 83% |
| | (2) No | 4 | 100% | 11 | 65% | 21 | 66% | 19 | 49% | 2 | 17% |
| Total | | 4 | 100% | 17 | 100% | 32 | 100% | 39 | 100% | 12 | 100% |

Table 7c.86. [Q22|Q7]a Adopter type by Time flexibility

| Scale | | Q22 | | | | | | | | | |
|-------|----------------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q7 | 1 (Inflexible) | 1 | 25% | 7 | 41% | 9 | 27% | 3 | 8% | 2 | 17% |
| | 2 | - | - | 3 | 18% | 7 | 21% | 13 | 33% | 3 | 25% |
| | 3 | 1 | 25% | 4 | 24% | 10 | 30% | 18 | 46% | 4 | 33% |
| | 4(Flexible) | 2 | 50% | 3 | 18% | 7 | 21% | 5 | 13% | 3 | 25% |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 39 | 100% | 12 | 100% |

Table 7c.87. [Q22|Q7]b Adopter type by Time flexibility (calculated flexibility)

| Scale | | Factor | Q22 | | | | |
|------------------------|----------------|--------|-------------|------|------|------|---------------|
| | | | 1 (Laggard) | 2 | 3 | 4 | 5 (Innovator) |
| Q7 | 1 (Inflexible) | 1 | 0.25 | 0.41 | 0.27 | 0.08 | 0.17 |
| | 2 | 2 | 0.00 | 0.35 | 0.42 | 0.67 | 0.50 |
| | 3 | 3 | 0.75 | 0.71 | 0.91 | 1.38 | 1.00 |
| | 4(Flexible) | 4 | 2.00 | 0.71 | 0.85 | 0.51 | 1.00 |
| Calculated flexibility | | | 3.00 | 2.18 | 2.45 | 2.64 | 2.67 |

Table 7c.88. [Q22|Q8]a Adopter type by Place flexibility

| Scale | | Q22 | | | | | | | | | |
|-------|----------------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q8 | 1 (Inflexible) | 2 | 50% | 5 | 29% | 17 | 52% | 8 | 21% | 6 | 50% |
| | 2 | 2 | 50% | 6 | 35% | 8 | 24% | 18 | 47% | 5 | 42% |
| | 3 | - | - | 3 | 18% | 5 | 15% | 8 | 21% | 1 | 8% |
| | 4 (Flexible) | - | - | 3 | 18% | 3 | 9% | 4 | 11% | - | - |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 38 | 100% | 12 | 100% |

Table 7c.89. [Q22|Q8]b Adopter type by Place flexibility (calculated flexibility)

| Scale | | Factor | Q22 | | | | |
|------------------------|----------------|--------|-------------|------|------|------|---------------|
| | | | 1 (Laggard) | 2 | 3 | 4 | 5 (Innovator) |
| Q8 | 1 (Inflexible) | 1 | 0.50 | 0.29 | 0.52 | 0.21 | 0.50 |
| | 2 | 2 | 1.00 | 0.71 | 0.48 | 0.95 | 0.83 |
| | 3 | 3 | - | 0.53 | 0.45 | 0.63 | 0.25 |
| | 4(Flexible) | 4 | - | 0.71 | 0.36 | 0.42 | - |
| Calculated flexibility | | | 1.50 | 2.24 | 1.82 | 2.21 | 1.58 |

Table 7c.90. [Q22|Q9]a Adopter type by importance of face-to-face interaction

| Scale | | Q22 | | | | | | | | | |
|-------|-----------------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q9 | 1 (Unimportant) | - | - | 2 | 12% | 2 | 6% | 2 | 5% | 2 | 17% |
| | 2 | 1 | 25% | 4 | 24% | 8 | 24% | 3 | 8% | - | - |
| | 3 | 1 | 25% | 8 | 47% | 15 | 45% | 17 | 44% | 6 | 50% |
| | 4 (Important) | 2 | 50% | 3 | 18% | 8 | 24% | 17 | 44% | 4 | 33% |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 39 | 100% | 12 | 100% |

Table 7c.91. [Q22|Q9]b Adopter type by importance of face-to-face interaction (calculated flexibility)

| Scale | | Factor | Q22 | | | | |
|------------------------|-----------------|--------|-------------|------|------|------|---------------|
| | | | 1 (Laggard) | 2 | 3 | 4 | 5 (Innovator) |
| Q9 | 1 (Unimportant) | 1 | - | 0.12 | 0.06 | 0.05 | 0.17 |
| | 2 | 2 | 0.25 | 0.24 | 0.24 | 0.08 | - |
| | 3 | 3 | 0.25 | 0.47 | 0.45 | 0.44 | 0.50 |
| | 4(Important) | 4 | 0.50 | 0.18 | 0.24 | 0.44 | 0.33 |
| Calculated flexibility | | | 3.25 | 2.71 | 2.88 | 3.26 | 3.00 |

Table 7c.92. [Q22|Q10]a Adopter type by level of bureaucracy

| Scale | | Q22 | | | | | | | | | |
|-------|----------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q10 | 1 (Low) | 2 | 50% | 4 | 24% | 13 | 39% | 4 | 10% | 5 | 42% |
| | 2 | 2 | 50% | 8 | 47% | 8 | 24% | 14 | 36% | 4 | 33% |
| | 3 | - | - | 5 | 29% | 9 | 27% | 17 | 44% | 1 | 8% |
| | 4 (High) | - | - | - | - | 3 | 9% | 4 | 10% | 2 | 17% |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 39 | 100% | 12 | 100% |

Table 7c.93. [Q22|Q10]b Adopter type by level of bureaucracy (calculated flexibility)

| Scale | | Factor | Q22 | | | | |
|------------------------|---------|--------|-------------|------|------|------|---------------|
| | | | 1 (Laggard) | 2 | 3 | 4 | 5 (Innovator) |
| Q10 | 1 (Low) | 1 | 0.50 | 0.24 | 0.39 | 0.10 | 0.42 |
| | 2 | 2 | 0.50 | 0.47 | 0.24 | 0.36 | 0.33 |
| | 3 | 3 | - | 0.29 | 0.27 | 0.44 | 0.08 |
| | 4(High) | 4 | - | - | 0.09 | 0.10 | 0.17 |
| Calculated flexibility | | | 1.50 | 2.06 | 2.06 | 2.54 | 2.00 |

Table 7c.94. [Q22|Q24]a Adopter type by frequency of printing emails

| Scale | | Q22 | | | | | | | | | |
|-------|------------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q24 | 1 (Always) | - | - | 2 | 12% | 1 | 3% | 3 | 8% | - | - |
| | 2 | 1 | 25% | 6 | 35% | 10 | 30% | 11 | 28% | 3 | 25% |
| | 3 | - | - | 4 | 24% | 13 | 40% | 17 | 43% | 6 | 50% |
| | 4 (Never) | 3 | 75% | 5 | 29% | 9 | 27% | 8 | 21% | 3 | 25% |
| Total | | 4 | 100% | 17 | 100% | 33 | 100% | 39 | 100% | 12 | 100% |

Table 7c.95. [Q22|Q24]b Adopter type by frequency of printing emails (calculated frequency)

| Scale | | Factor | Q22 | | | | |
|------------------------|------------|--------|-------------|------|------|------|---------------|
| | | | 1 (Laggard) | 2 | 3 | 4 | 5 (Innovator) |
| Q24 | 1 (Always) | 1 | - | 0.12 | 0.03 | 0.08 | - |
| | 2 | 2 | 0.50 | 0.70 | 0.60 | 0.56 | 0.50 |
| | 3 | 3 | - | 0.72 | 1.20 | 1.29 | 1.50 |
| | 4(Never) | 4 | 2.25 | 1.16 | 1.08 | 0.84 | 1.00 |
| Calculated flexibility | | | 2.75 | 2.70 | 2.91 | 2.77 | 3.00 |

Table 7c.96. [Q22|Q25] Adopter type by scanning of hardcopy documents

| (Code)Description | | Q22 | | | | | | | | | |
|-------------------|---------|-------------|------|----|------|----|------|----|------|---------------|------|
| | | 1 (Laggard) | | 2 | | 3 | | 4 | | 5 (Innovator) | |
| Q25 | (1) Yes | - | - | 10 | 59% | 16 | 52% | 28 | 72% | 3 | 25% |
| | (2) No | 4 | 100% | 7 | 41% | 15 | 48% | 11 | 28% | 9 | 75% |
| Total | | 4 | 100% | 17 | 100% | 31 | 100% | 39 | 100% | 12 | 100% |

A7C.4.5 Alternative Ways of Working

Table 7c.97. [Q27|A/B|Q33] Crossanalysis: Hot-desking by profession and company size

| | Yes | | No | | Total | |
|-------------------|-----|-----|----|-----|-------|-------------|
| Group A | 13 | 28% | 33 | 72% | 46 | 100% |
| Group B | 7 | 13% | 49 | 88% | 56 | 100% |
| Group 1-10 | 15 | 25% | 44 | 75% | 59 | 100% |
| Group 11+ | 5 | 12% | 38 | 88% | 43 | 100% |

Table 7c.98. [Q29|Q33|A/B] Crossanalysis: Teleworking by Profession and Company size

| Code | Description | Group A | | Group B | | Total |
|--------------|---|-----------|-----------|-----------|-----------|------------|
| | | 1-10 | 11+ | 1-10 | 11+ | |
| 1 | Yes, and I work from home | 9 | 2 | 8 | 4 | 23 |
| 2 | Yes, but I do not use this option | 7 | 2 | 5 | 9 | 23 |
| 3 | No, but I would like to have the option | 3 | 4 | 2 | 3 | 12 |
| 4 | No, but I rather go to the office | 10 | 7 | 12 | 12 | 41 |
| 5 | With or without option, I would rather go to the office | 2 | - | 1 | - | 3 |
| Total | | 31 | 15 | 28 | 28 | 102 |

Table 7c.99. [Q30|Q29]a Crossanalysis: Pros and cons by Teleworker/non-Teleworker (frequency)

| | | Telework | | Do not Telework | | Total |
|--------------|-------------------------------------|------------------|----------------|------------------|----------------|-------|
| | | Chose the option | Did not choose | Chose the option | Did not choose | |
| Pros | More free time | 10 | 16 | 25 | 54 | 105 |
| | Increased productivity | 14 | 12 | 22 | 57 | 105 |
| | Less commuting time | 21 | 5 | 63 | 16 | 105 |
| | Freeing up of office space | 4 | 22 | 18 | 61 | 105 |
| | More time with my family | 15 | 11 | 32 | 47 | 105 |
| Cons | Isolation | 12 | 14 | 49 | 30 | 105 |
| | Longer working hours | 5 | 21 | 22 | 57 | 105 |
| | Lack of motivation | 3 | 23 | 39 | 40 | 105 |
| | Lack of a suitable environment | 5 | 21 | 36 | 43 | 105 |
| | No boundaries between home and work | 12 | 14 | 63 | 16 | 105 |
| Total | | 101 | 159 | 369 | 421 | |

Table 7c.100. [Q30|Q29]b Crossanalysis: Pros and cons by Teleworker/non-Teleworker (Percentage)

| | | Telework | | Do not Telework | | Telework | Do not telework |
|------|-------------------------------------|------------------|----------------|------------------|----------------|----------|-----------------|
| | | Chose the option | Did not choose | Chose the option | Did not choose | Chose | Chose |
| Pros | More free time | 38% | 62% | 32% | 68% | 49% | 41% |
| | Increased productivity | 54% | 46% | 28% | 72% | | |
| | Less commuting time | 81% | 19% | 80% | 20% | | |
| | Freeing up of office space | 15% | 85% | 23% | 77% | | |
| | More time with my family | 58% | 42% | 41% | 59% | | |
| Cons | Isolation | 46% | 54% | 62% | 38% | 28% | 53% |
| | Longer working hours | 19% | 81% | 28% | 72% | | |
| | Lack of motivation | 12% | 88% | 49% | 51% | | |
| | Lack of a suitable environment | 19% | 81% | 46% | 54% | | |
| | No boundaries between home and work | 46% | 54% | 80% | 20% | | |

Appendix 8a

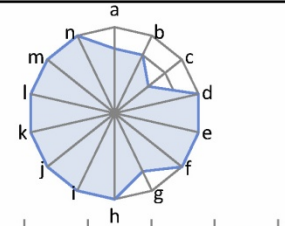
Survey and WSD Reports

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|-----------|-------------------------|----------------------|
| Type of Building..... | NR | | |
| Layout..... | Open-plan | Number of employees.... | 21-40 |
| Respondent's: Age..... | 50's | Gender.... | M |
| | | Position..... | Project Co-ordinator |

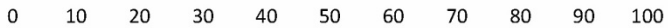
Office Environment

| | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 3 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 3 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 2 | j) Office size..... | 4 |
| d) Noise comfort..... | 4 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 4 | l) Storage space..... | 4 |
| f) Visual privacy..... | 4 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 3 | n) Overall satisfaction..... | 4 |



Type of work

| | |
|--------------------------------|-----|
| | % |
| a) Individual Work..... | 80 |
| b) Face to Face..... | 15 |
| c) Building Relationships..... | 5 |
| | 100 |



Work / Life Balance

| | | | |
|-----------------------------|-----|-----------------------|-------|
| Working hrs. Per week..... | 40 | Work on weekends..... | Never |
| Happy with W/L Balance..... | Yes | Take work home..... | Never |

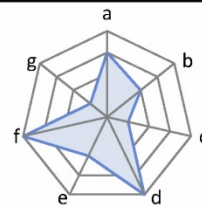
Technology at work

| | | | |
|----------------------------|------------------------|----------------------------|---------------|
| Adopter type..... | Innovator | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | No |
| Internet connection..... | Broadband | E-mails are..... | Mosly printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | E-mails only | | |
| Type of monitors used..... | Only Flat panel | | |

| | |
|---------------------|--|
| Technology at home: | Computer, Printer, Broadband / Wireless Connection |
|---------------------|--|

Alternative Ways of Working (AWW)

| | |
|--------------------------------------|---|
| a) Time flexibility..... | 3 |
| b) Place flexibility..... | 2 |
| c) Face-to-face interaction (4)..... | 1 |
| d) Bureaucracy level (1)..... | 4 |
| e) Competitiveness (3)..... | 2 |
| f) Computer dependency..... | 4 |
| g) Workstation dependency (4)..... | 1 |
| Hot-desking implemented..... | No |
| Preferred interaction space..... | Each other's workstation / office |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car |



| Perceived advantages of AWW | Perceived disadvantages (AWW) |
|---------------------------------|-----------------------------------|
| More free time..... | Isolation..... |
| Increased productivity..... | Longer working hrs..... |
| Less commuting time..... | Lack of motivation..... |
| Freeing up of office space..... | Lack of suitable environment..... |
| More time with family..... | No boundaries Home/Work..... |

| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 40 min by Car |
| Office located in: | *Refer to Case Study description |

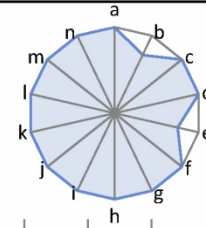
Questionnaire ID: CSA-02

INDIVIDUAL QUESTIONNAIRE REPORT

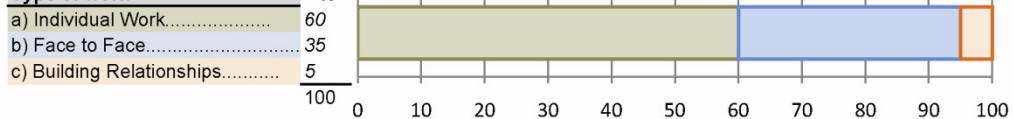
| | | | |
|------------------------|--|-------------------------------|-----------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | Number of employees.... 21-40 | |
| Respondent's: Age..... | 50's | Gender.... M | Position.... Director |

Office Environment

| | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 4 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 3 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 4 | j) Office size..... | 4 |
| d) Noise comfort..... | 4 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 3 | l) Storage space..... | 4 |
| f) Visual privacy..... | 4 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 4 | n) Overall satisfaction..... | 4 |



Type of work



Work / Life Balance

| | | | |
|-----------------------------|-----|-----------------------|------------|
| Working hrs. Per week..... | 40 | Work on weekends..... | Frequently |
| Happy with W/L Balance..... | Yes | Take work home..... | Frequently |

Technology at work

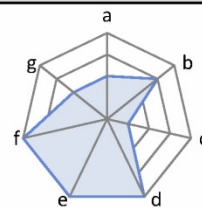
| | | | |
|----------------------------|------------------------|----------------------------|----------------|
| Adopter type..... | Early Adopter | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | Yes |
| Internet connection..... | Broadband | E-mails are..... | Rarely printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | E-mails only | | |
| Type of monitors used..... | Only Flat panel | | |

Technology at home:

, Fax

Alternative Ways of Working (AWW)

| | |
|--------------------------------------|---|
| a) Time flexibility..... | 2 |
| b) Place flexibility..... | 3 |
| c) Face-to-face interaction (4)..... | 1 |
| d) Bureaucracy level (1)..... | 4 |
| e) Competitiveness (1)..... | 4 |
| f) Computer dependency..... | 4 |
| g) Workstation dependency (3)..... | 2 |
| Hot-desking implemented..... | Yes |
| Preferred interaction space..... | Each other's workstation / office |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car |



| Perceived advantages of AWW | Perceived disadvantages (AWW) |
|---------------------------------|-------------------------------------|
| More free time..... | Isolation..... ✓ |
| Increased productivity..... | Longer working hrs..... ✓ |
| Less commuting time..... ✓ | Lack of motivation..... ✓ |
| Freeing up of office space..... | Lack of suitable environment..... ✓ |
| More time with family..... | No boundaries Home/Work..... |

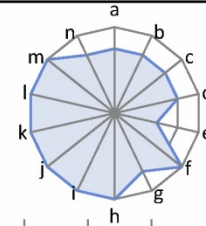
| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 20 min by Car |
| Office located in: | *Refer to Case Study description |

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|-------------------------------|------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | Number of employees.... 21-40 | |
| Respondent's: Age..... | 30's | Gender.... M | Position..... Director |

Office Environment

| | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 3 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 3 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 3 | j) Office size..... | 4 |
| d) Noise comfort..... | 3 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 2 | l) Storage space..... | 4 |
| f) Visual privacy..... | 4 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 3 | n) Overall satisfaction..... | 3 |



Type of work

| | |
|--------------------------------|-----|
| a) Individual Work..... | 80 |
| b) Face to Face..... | 15 |
| c) Building Relationships..... | 5 |
| % | 100 |

Work / Life Balance

| | | | |
|-----------------------------|-----|-----------------------|-----------|
| Working hrs. Per week..... | 40 | Work on weekends..... | Sometimes |
| Happy with W/L Balance..... | Yes | Take work home..... | Sometimes |

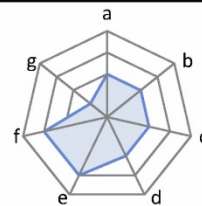
Technology at work

| | | | |
|----------------------------|----------------------------|----------------------------|----------------|
| Adopter type..... | Early Majority | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | No |
| Internet connection..... | Broadband | E-mails are..... | Mostly printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | Mostly E-mails, some Faxes | | |
| Type of monitors used..... | Only Flat panel | | |

| | |
|---------------------|--|
| Technology at home: | Computer, Printer, Broadband / Wireless Connection |
|---------------------|--|

Alternative Ways of Working (AWW)

| | |
|--------------------------------------|---|
| a) Time flexibility..... | 2 |
| b) Place flexibility..... | 2 |
| c) Face-to-face interaction (3)..... | 2 |
| d) Bureaucracy level (3)..... | 2 |
| e) Competitiveness (2)..... | 3 |
| f) Computer dependency..... | 3 |
| g) Workstation dependency (4)..... | 1 |
| Hot-desking implemented..... | No |
| Preferred interaction space..... | Each other's workstation / office |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car |



| Perceived advantages of AWW | Perceived disadvantages (AWW) |
|---------------------------------|--------------------------------|
| More free time..... | Isolation..... ✓ |
| Increased productivity..... | Longer working hrs..... |
| Less commuting time..... ✓ | Lack of motivation..... |
| Freeing up of office space..... | Lack of suitable environment ✓ |
| More time with family..... ✓ | No boundaries Home/Work..... |

| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 60 min by Car |
| Office located in: | *Refer to Case Study description |

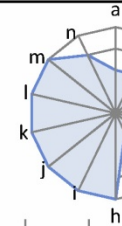
Questionnaire ID: CSA-04

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|-------------------------------|------------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | Number of employees.... 21-40 | |
| Respondent's: Age..... | 20's | Gender.... F | Position..... Project Co-ordinator |

Office Environment

| | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 2 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 2 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 3 | j) Office size..... | 4 |
| d) Noise comfort..... | 4 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 3 | l) Storage space..... | 4 |
| f) Visual privacy..... | 3 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 1 | n) Overall satisfaction..... | 3 |



Type of work

| | | |
|--------------------------------|-----|--|
| | % | |
| a) Individual Work..... | 60 | |
| b) Face to Face..... | 30 | |
| c) Building Relationships..... | 10 | |
| | 100 | |

Work / Life Balance

| | | | |
|-----------------------------|-----|-----------------------|-----------|
| Working hrs. Per week..... | 39 | Work on weekends..... | Sometimes |
| Happy with W/L Balance..... | Yes | Take work home..... | Never |

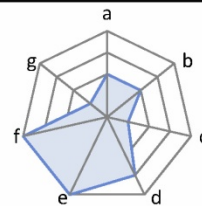
Technology at work

| | | | |
|----------------------------|----------------------------|----------------------------|----------------|
| Adopter type..... | Early Majority | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | No |
| Internet connection..... | Broadband | E-mails are..... | Always printed |
| Wireless network..... | NR | | |
| E-mails vs. Fax..... | Mostly E-mails, some Faxes | | |
| Type of monitors used..... | Only Flat panel | | |

| | |
|---------------------|--|
| Technology at home: | Computer, Printer, Broadband / Wireless Connection |
|---------------------|--|

Alternative Ways of Working (AWW)

| | | |
|--------------------------------------|---|--|
| a) Time flexibility..... | 2 | |
| b) Place flexibility..... | 2 | |
| c) Face-to-face interaction (4)..... | 1 | |
| d) Bureaucracy level (2)..... | 3 | |
| e) Competitiveness (1)..... | 4 | |
| f) Computer dependency..... | 4 | |
| g) Workstation dependency (4)..... | 1 | |
| Hot-desking implemented..... | No | |
| Preferred interaction space..... | Each other's workstation / office | |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. | |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car | |



| Perceived advantages of AWW | Perceived disadvantages (AWW) |
|---------------------------------|-----------------------------------|
| More free time..... | Isolation..... |
| Increased productivity..... | Longer working hrs..... |
| Less commuting time..... | Lack of motivation..... |
| Freeing up of office space..... | Lack of suitable environment..... |
| More time with family..... | No boundaries Home/Work..... |

| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 25 min by Car |
| Office located in: | *Refer to Case Study description |

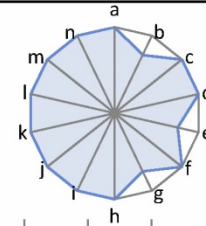
Questionnaire ID: CSA-05

INDIVIDUAL QUESTIONNAIRE REPORT

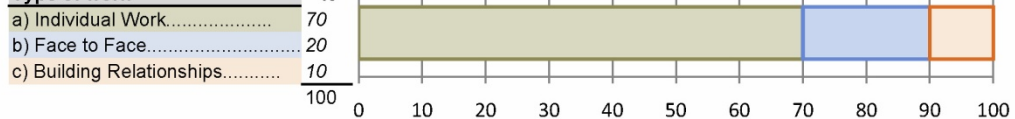
| | | | |
|------------------------|--|-------------------------|----------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | Number of employees.... | 21-40 |
| Respondent's: Age..... | 30's | Gender.... | M |
| | | Position..... | Director |

Office Environment

| | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 4 | h) Spatial arrangement..... | 4 |
| b) Ventilation comfort..... | 3 | i) Furniture arrangement..... | 4 |
| c) Illumination comfort..... | 4 | j) Office size..... | 4 |
| d) Noise comfort..... | 4 | k) Office storage..... | 4 |
| e) Frequency of distractions..... | 3 | l) Storage space..... | 4 |
| f) Visual privacy..... | 4 | m) Space on workstation..... | 4 |
| g) Voice privacy..... | 3 | n) Overall satisfaction..... | 4 |



Type of work



Work / Life Balance

| | | | |
|-----------------------------|----|-----------------------|-----------|
| Working hrs. Per week..... | 45 | Work on weekends..... | Sometimes |
| Happy with W/L Balance..... | No | Take work home..... | Never |

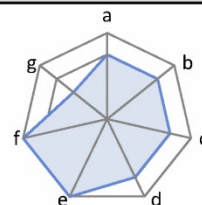
Technology at work

| | | | |
|----------------------------|----------------------------|----------------------------|----------------|
| Adopter type..... | Late Majority | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | Yes |
| Internet connection..... | Broadband | E-mails are..... | Rarely printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | Mostly E-mails, some Faxes | | |
| Type of monitors used..... | Only Flat panel | | |

Technology at home: Computer, Broadband / Wireless Connection

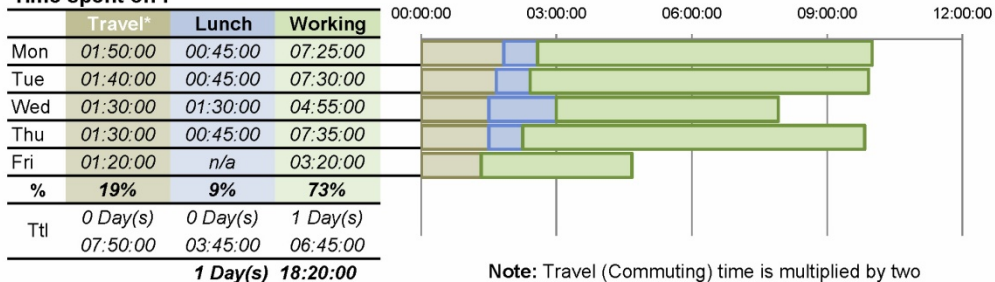
Alternative Ways of Working (AWW)

| | |
|--------------------------------------|---|
| a) Time flexibility..... | 3 |
| b) Place flexibility..... | 3 |
| c) Face-to-face interaction (2)..... | 3 |
| d) Bureaucracy level (2)..... | 3 |
| e) Competitiveness (1)..... | 4 |
| f) Computer dependency..... | 4 |
| g) Workstation dependency (3)..... | 2 |
| Hot-desking implemented..... | No |
| Preferred interaction space..... | Each other's workstation / office |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. |
| 'Green' policies in place..... | Electricity, Water, Paper, Use of Car |

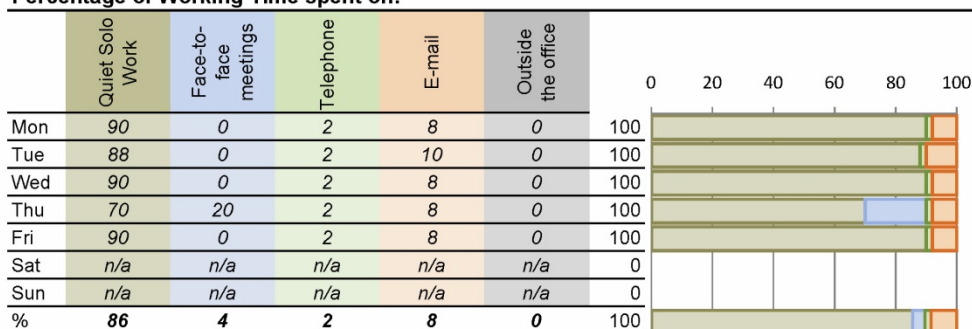


| Perceived advantages of AWW | Perceived disadvantages (AWW) |
|---------------------------------|--------------------------------|
| More free time..... | Isolation..... ✓ |
| Increased productivity..... | Longer working hrs..... |
| Less commuting time..... ✓ | Lack of motivation..... |
| Freeing up of office space..... | Lack of suitable environment |
| More time with family..... ✓ | No boundaries Home/Work..... ✓ |

| | |
|----------------------------------|----------------------------------|
| Commuting time (Return-min)..... | 75 min by Car |
| Office located in: | *Refer to Case Study description |

Work Sampling Diary: **CSA-01****WORK SAMPLING DIARY REPORT****Time spent on :****Hours worked on weekend**

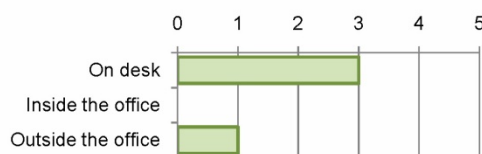
Sat n/a
Sun n/a

Percentage of Working Time spent on:**Could have done today's work from outside the office**

Mon 1
Tue 1
Wed 1
Thu 1
Fri 1

Took work home

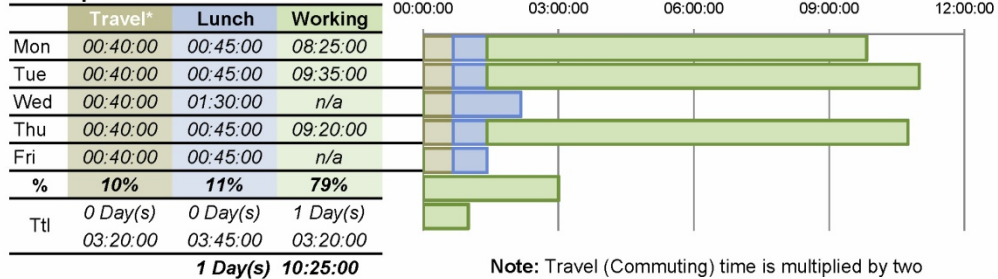
No
No
No
No
No

Number of times that had lunch**Week representativeness:**

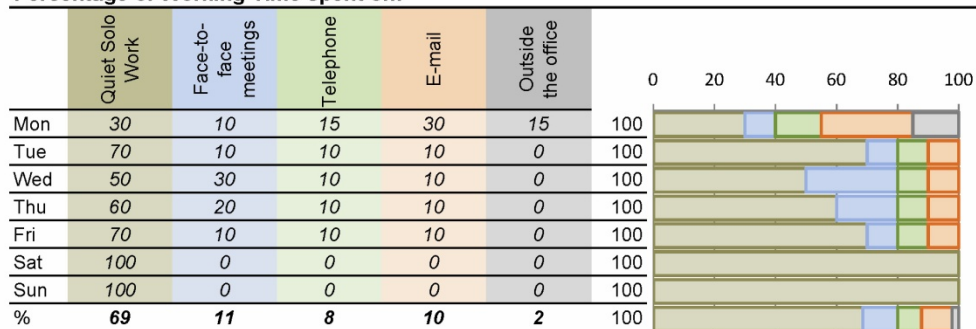
Quieter week than usual, however average time spent on tasks much the same.

Comments:

MON: Quiet day spent mainly on fine tuning outstanding projects | TUE: No comments | WED: Took 2 hours off in afternoon to carry out personal business | THU: No comments | FRI: Half day off left office at 12:00 Midday | SAT: n/a | SUN: n/a | OVERALL: No comments

Work Sampling Diary: **CSA-02****WORK SAMPLING DIARY REPORT****Time spent on :****Hours worked on weekend**

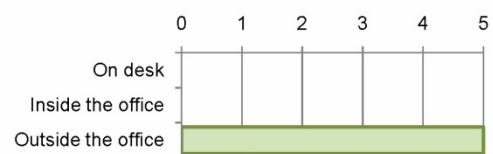
| | | |
|-----|---------|----------------------|
| Sat | 3:00:00 | From Home and Office |
| Sun | 1:00:00 | From Home |

Percentage of Working Time spent on:**Could have done today's work from outside the office**

| | |
|-----|---|
| Mon | 1 |
| Tue | 1 |
| Wed | 1 |
| Thu | 1 |
| Fri | 3 |

Took work home

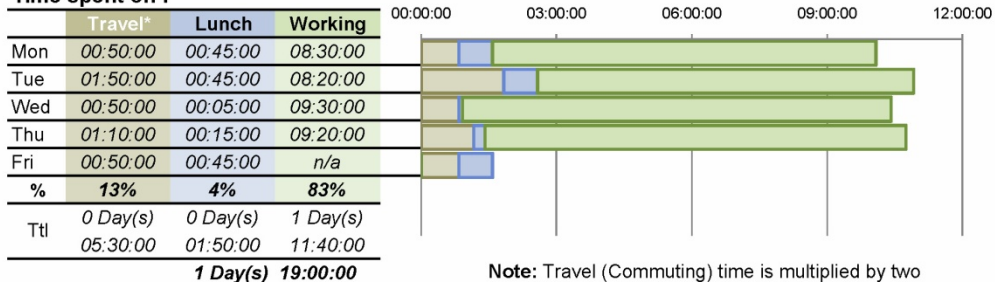
| |
|-----|
| No |
| No |
| No |
| Yes |
| n/a |

Number of times that had lunch**Week representativeness:**

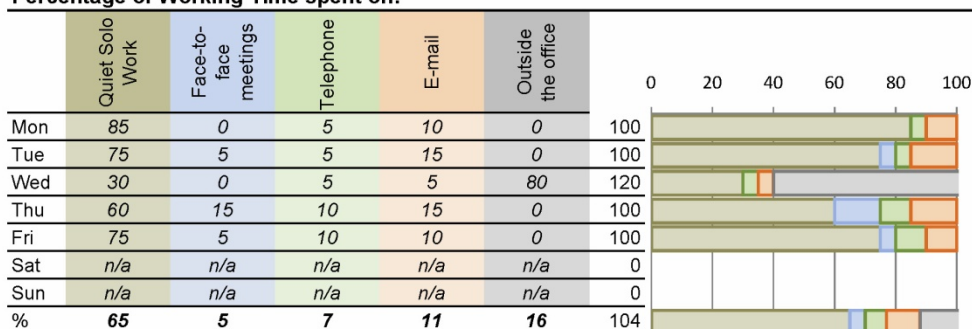
Additional work on weekend not normally undertaken (only for last month)

Comments:

MON: No Comments | TUE: No Comments | WED: No Comments | THU: No Comments | FRI: No Comments | SAT: No Comments | SUN: No Comments | OVERALL: No Comments

Work Sampling Diary: **CSA-03****WORK SAMPLING DIARY REPORT****Time spent on :****Hours worked on weekend**

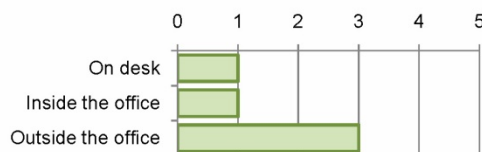
Sat n/a
Sun n/a

Percentage of Working Time spent on:**Could have done today's work from outside the office**

Mon 3
Tue 1
Wed 3
Thu 1
Fri 2

Took work home

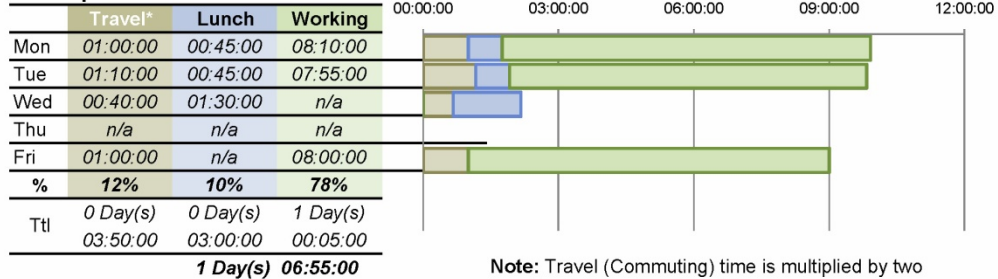
No
No
No
No
No

Number of times that had lunch**Week representativeness:**

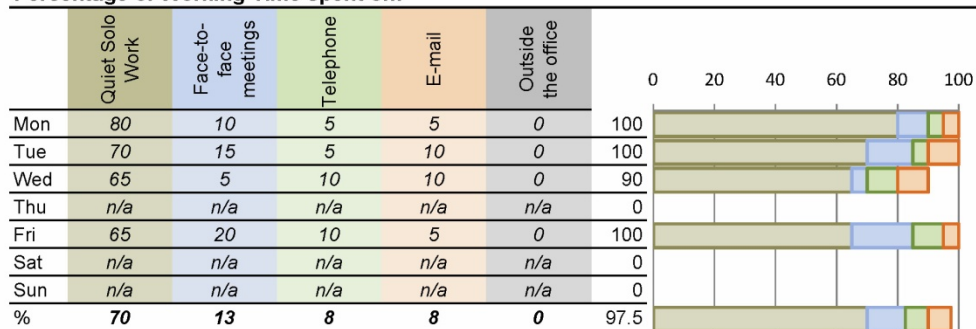
No Comments

Comments:

MON: Respond to emails/faxes and letters. Seminar (Architectural) 6-8 PM. | TUE: No Comments | WED: Had lunch in the Car. Site Meeting (Country). 20% Face-to-face meetings Outside the Office (60+20=80%). Rode bike to work (return). | THU: Rode bike to work (return) | FRI: No Comments | SAT: n/a | SUN: n/a | OVERALL: No Comments

Work Sampling Diary: **CSA-04****WORK SAMPLING DIARY REPORT****Time spent on :****Hours worked on weekend**

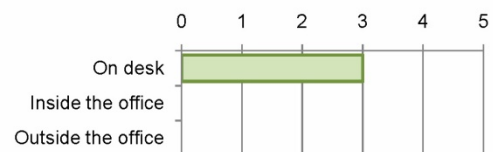
Sat n/a
Sun n/a

Percentage of Working Time spent on:**Could have done today's work from outside the office**

Mon 4
Tue 2
Wed 3
Thu n/a
Fri 2

Took work home

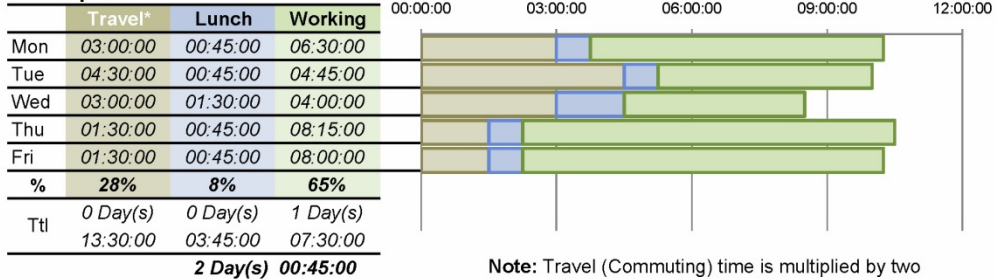
No
No
n/a
n/a
No

Number of times that had lunch**Week representativeness:**

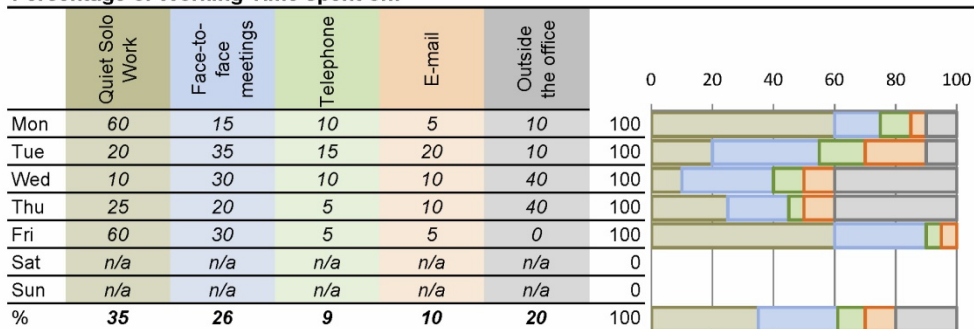
No Comments

Comments:

MON: I am working on a residential project. Documenting, desining & liasing with the client on my own. | TUE: A few Rep meetings today. Short, 10 mins each. | WED: Long lunches on Wednesdays | THU: Sick today with the flu | FRI: Personal appointment in morning. No lunch break taken. | SAT: n/a | SUN: n/a | OVERALL: No Comments

Work Sampling Diary: **CSA-05****WORK SAMPLING DIARY REPORT****Time spent on :****Hours worked on weekend**

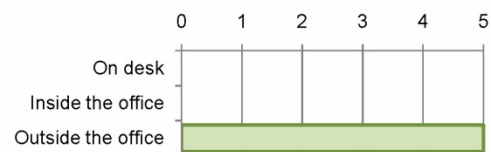
Sat n/a
Sun n/a

Percentage of Working Time spent on:**Could have done today's work from outside the office**

Mon 3
Tue 1
Wed 3
Thu 3
Fri 3

Took work home

No
No
No
n/a
No

Number of times that had lunch**Week representativeness:**

Good representation of an average week

Comments:

MON: Had meeting at 9:30 am on my way to work. Had seminar (Work related) after work 6PM - 8PM | TUE: Had meeting at 9am on my way to work. Had a meeting after work at 4:30 pm on my way home. | WED: Had 8:30AM meeting on the way to work. Had 3:30 PM Meeting on the way home from work. | THU: Had a meeting at 10AM in the city | FRI: No Comments | SAT: n/a | SUN: n/a | OVERALL: No Comments

Appendix 9a

CS-B Data quality

Table 9a.1 indicates the surveys and WSD returned based on the code described in Appendix 6c (Instructions). The date covering the study week is indicated below the code under each WSD.

Table 9a.1. Returned surveys and WSD

| ID | PC | Mac | Survey old office | Survey new office | WSD old office | WSD new office |
|--------|----|-----|------------------------------|----------------------|--|---|
| CSB-1a | ✓ | | CSB-PC-S1-O-C | | CSB-PC-D1-O-C 22-28/Sep/08 | |
| CSB-1b | ✓ | | | CSB-PC-S1-O-N | | CSB-PC-D2 ¹ -O-N 13-19/Oct/08 |
| CSB-2a | ✓ | | CSB-PC-S2-O-C | | CSB-PC-D2-O-C 22-28/Sep/08 | |
| CSB-2b | ✓ | | | CSB-PC-S2-O-N | | CSB-PC-D2-O-N 15-21/Dec/08 |
| CSB-3a | ✓ | | CSB-PC-S3-O-C | | CSB-PC-D3-O-C 22-28/Sep/08 | |
| CSB-3b | ✓ | | | CSB-PC-S3-O-N | | CSB-PC-D3-O-N 17-23/Nov/08 |
| CSB-4a | | ✓ | CSB-Mac-S1-O-C | | CSB-Mac-D1-O-C 22-28/Sep/08 | |
| CSB-4b | | ✓ | | CSB-Mac-S1-O-N | | CSB-Mac-D1-O-N 27-02/Nov/08 |
| CSB-5a | | ✓ | CSB-Mac-S2-O-C | | CSB-Mac-D2-O-C ??/??/08 | |
| CSB-5b | | ✓ | | CSB-Mac-S2-O-N | | CSB-Mac-D2-O-N 3-9/Nov/08 |
| CSB-6a | | ✓ | CSB-Mac-S2 ² -O-C | | CSB-Mac-D2 ³ -O-C 22-28/Sep/08 | |
| CSB-6b | | ✓ | | | | CSB-Mac-D2 ⁴ -O-N 2-9 ⁵ /10/08 |

¹ WSD was labelled 'D2', should be D1

² Questionnaire was labelled 'S2', should be S3.

³ WSD was labelled 'D2', should be D3

⁴ WSD was labelled 'D2', should be D3

⁵ WSD not starting on Monday

Appendix 9a

From the above table, a total of 12 completed surveys and WSD were received. These 12 questionnaires relate to 6 unique respondents, from which 3 are Account Managers (PC users) and 3 Designers (Mac users). The association of Account Managers with PC's and Designers with Mac's is explained in Chapter 9. Each respondent has a survey and sampling diary from the old office '(a)' and the new office '(b)'.

Table 9a.2. Quality of data

| ID | <u>Question:</u> Comment |
|---------|--|
| CSB-05a | <u>2.H)</u> General Spatial arrangement: Unanswered <u>13)</u> On average, how many hours do you work per week: Unanswered |
| CSB-05b | <u>2.H)</u> General Spatial arrangement: Unanswered <u>32)</u> On a typical day, which is you main way of transportation to get to work?: two answers provided: Public transport and Car (Car used for analysis) |
| CSB-06a | <u>16)</u> Are you happy with your work/life balance?: Respondent ticked 'Yes', but also put a tick in the middle point between 'Yes' and 'No'. Yes is taken for analysis. <u>29)</u> Is teleworking an option at your workplace?: Unanswered |
| CSB-06b | <u>29)</u> Is teleworking an option at your workplace?: Two options were selected: 2)'I do not use this option, 4)'I rather go to the office; and I rather go to the office'. The latter was used for analysis. |

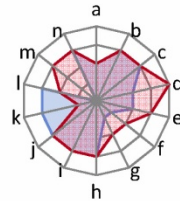
Appendix 9b

Survey and WSD Reports

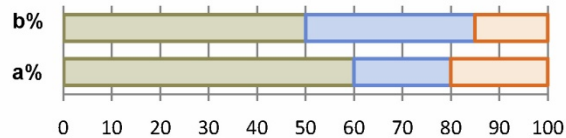
INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|------------|-------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | | Number of employees.... 21-40 |
| Respondent's: Age..... | 20's | Gender.... | F |

| Office Environment | a | b | | a | b |
|-----------------------------------|---|---|-------------------------------|---|---|
| a) Temperature comfort..... | 2 | 2 | h) Spatial arrangement..... | 3 | 3 |
| b) Ventilation comfort..... | 3 | 3 | i) Furniture arrangement..... | 3 | 3 |
| c) Illumination comfort..... | 3 | 3 | j) Office size..... | 3 | 3 |
| d) Noise comfort..... | 2 | 4 | k) Office storage..... | 3 | 1 |
| e) Frequency of distractions..... | 2 | 3 | l) Storage space..... | 3 | 2 |
| f) Visual privacy..... | 1 | 2 | m) Space on workstation..... | 0 | 3 |
| g) Voice privacy..... | 1 | 2 | n) Overall satisfaction..... | 3 | 3 |



| Type of work | a% | b% |
|--------------------------------|-----|-----|
| a) Individual Work..... | 60 | 50 |
| b) Face to Face..... | 20 | 35 |
| c) Building Relationships..... | 20 | 15 |
| | 100 | 100 |

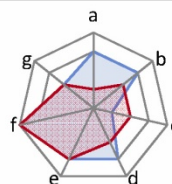


| Work / Life Balance | a / b | | a / b |
|-----------------------------|-----------|------------------------|-----------------------|
| Working hrs. Per week..... | 44 / 42 | Work on weekends | Sometimes / Sometimes |
| Happy with W/L Balance..... | Yes / Yes | Take work home..... | Sometimes / Sometimes |

| Technology at work | a / b | | a / b |
|----------------------------|---|---------------------------|----------------------------------|
| Adopter type..... | Early Majority / Early Majority | Website..... | Yes / Yes |
| Type of computer | Desktop / Desktop | Documents are scan'd..... | Yes / No |
| Internet connection..... | Broadband / Broadband | Emails are... .. | Mostly printed Rarely printed |
| Wireless network..... | Yes / Yes | | |
| E-mails vs. Fax..... | E-mails only / E-mails only | | |
| Type of monitors used..... | Mostly Flat panel, some CRT / Only Flat panel | | |

| | |
|---------------------|---|
| Technology at home: | a: Computer, Printer, Broadband / Wireless Connection |
|---------------------|---|

| AWW | a | b |
|--------------------------------------|---|----|
| a) Time flexibility..... | 3 | 1 |
| b) Place flexibility..... | 3 | 2 |
| c) Face-to-face interaction (4)..... | 1 | 2 |
| d) Bureaucracy level (2)..... | 3 | 2 |
| e) Competitiveness (2)..... | 3 | 3 |
| f) Computer dependency..... | 4 | 4 |
| g) Workstation dependency (3)..... | 2 | 2 |
| Hot-desking implemented..... | No | No |
| Preferred interaction space..... | Meeting rooms / Meeting rooms | |
| Teleworking option offered..... | No, I rather go to the office. / No, I rather go to the office. | |



| Frequency of variance (a/b) | |
|-----------------------------|-----------|
| Office environment: | 7 |
| Other: | 14 |
| Total: | 21 |

| Advantages of AWW | a | b | Disadvantages (AWW) | a | b |
|---------------------------------|---|---|-----------------------------|---|---|
| More free time..... | | | Isolation..... | ✓ | ✓ |
| Increased productivity..... | ✓ | ✓ | Longer working hrs..... | | |
| Less commuting time..... | ✓ | ✓ | Lack of motivation..... | | |
| Freeing up of office space..... | | | Lack of suitable environm't | | |
| More time with family..... | | | No boundaries H/W | | ✓ |

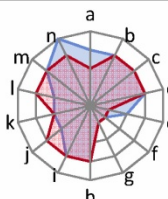
Commuting time (Return-min) (a/b).... 45 min by Car / 50 min by Car

Questionnaire ID: CSB-02ab

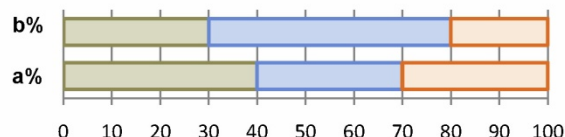
INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|------------|-------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | | Number of employees.... 21-40 |
| Respondent's: Age..... | 20's | Gender.... | F |

| Office Environment | a | b | | a | b |
|-----------------------------------|---|---|-------------------------------|---|---|
| a) Temperature comfort..... | 3 | 2 | h) Spatial arrangement..... | 3 | 3 |
| b) Ventilation comfort..... | 3 | 3 | i) Furniture arrangement..... | 3 | 3 |
| c) Illumination comfort..... | 3 | 3 | j) Office size..... | 2 | 3 |
| d) Noise comfort..... | 3 | 3 | k) Office storage..... | 2 | 2 |
| e) Frequency of distractions..... | 2 | 1 | l) Storage space..... | 2 | 3 |
| f) Visual privacy..... | 1 | 1 | m) Space on workstation..... | 3 | 3 |
| g) Voice privacy..... | 1 | 1 | n) Overall satisfaction..... | 4 | 3 |



| Type of work | a% | b% |
|--------------------------------|-----|-----|
| a) Individual Work..... | 40 | 30 |
| b) Face to Face..... | 30 | 50 |
| c) Building Relationships..... | 30 | 20 |
| | 100 | 100 |

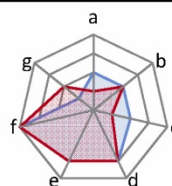


| Work / Life Balance | a / b | | a / b |
|-----------------------------|-----------|------------------------|------------------------|
| Working hrs. Per week..... | 45 / 50 | Work on weekends | Sometimes / Frequently |
| Happy with W/L Balance..... | Yes / Yes | Take work home..... | Sometimes / Frequently |

| Technology at work | a / b | | a / b |
|----------------------------|---|------------------------------|----------------|
| Adopter type..... | Early Adopter / Early Adopter | Website..... | Yes / Yes |
| Type of computer | Desktop / Desktop | Documents are scan'd..... | Yes / Yes |
| Internet connection..... | Broadband / Wireless | Emails are... Mostly printed | Mostly printed |
| Wireless network..... | Yes / Yes | | |
| E-mails vs. Fax..... | Mostly E-mails, some Faxes / E-mails only | | |
| Type of monitors used..... | Only Flat panel / Only Flat panel | | |

| | |
|---------------------|---|
| Technology at home: | a: Computer, Printer, Broadband / Wireless Connection |
|---------------------|---|

| AWW | a | b | |
|--------------------------------------|---|----|--|
| a) Time flexibility..... | 2 | 1 | |
| b) Place flexibility..... | 2 | 2 | |
| c) Face-to-face interaction (3)..... | 2 | 1 | |
| d) Bureaucracy level (2)..... | 3 | 3 | |
| e) Competitiveness (2)..... | 3 | 3 | |
| f) Computer dependency..... | 4 | 4 | |
| g) Workstation dependency (4)..... | 1 | 2 | |
| Hot-desking implemented..... | No | No | |
| Preferred interaction space..... | Meeting rooms / Meeting rooms | | |
| Teleworking option offered..... | No, but would like the option. / No, but would like the option. | | |



| Frequency of variance (a/b) | |
|-----------------------------|-----------|
| Office environment: | 5 |
| Other: | 19 |
| Total: | 24 |

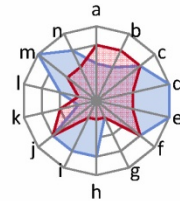
| Advantages of AWW | a | b | Disadvantages (AWW) | a | b |
|---------------------------------|---|---|-----------------------------|---|---|
| More free time..... | | | Isolation..... | ✓ | ✓ |
| Increased productivity..... | ✓ | ✓ | Longer working hrs..... | | |
| Less commuting time..... | ✓ | ✓ | Lack of motivation..... | | ✓ |
| Freeing up of office space..... | | | Lack of suitable environm't | | |
| More time with family..... | | ✓ | No boundaries H/W | ✓ | ✓ |

Commuting time (Return-min) (a/b).... 25 min by Public Transport / 45 min by Car

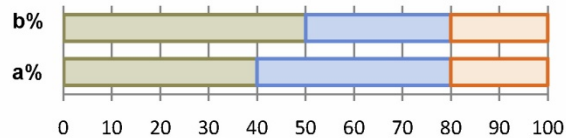
INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|------------|-------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | | Number of employees.... 21-40 |
| Respondent's: Age..... | 20's | Gender.... | F |

| Office Environment | a | b | | a | b |
|-----------------------------------|---|---|-------------------------------|---|---|
| a) Temperature comfort..... | 2 | 3 | h) Spatial arrangement..... | 3 | 1 |
| b) Ventilation comfort..... | 2 | 3 | i) Furniture arrangement..... | 3 | 1 |
| c) Illumination comfort..... | 3 | 3 | j) Office size..... | 3 | 3 |
| d) Noise comfort..... | 4 | 2 | k) Office storage..... | 1 | 2 |
| e) Frequency of distractions..... | 4 | 2 | l) Storage space..... | 2 | 1 |
| f) Visual privacy..... | 3 | 3 | m) Space on workstation..... | 4 | 2 |
| g) Voice privacy..... | 1 | 1 | n) Overall satisfaction..... | 3 | 2 |



| Type of work | a% | b% |
|--------------------------------|-----|-----|
| a) Individual Work..... | 40 | 50 |
| b) Face to Face..... | 40 | 30 |
| c) Building Relationships..... | 20 | 20 |
| | 100 | 100 |

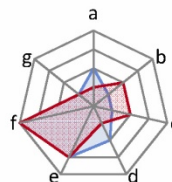


| Work / Life Balance | a / b | | a / b |
|-----------------------------|-----------|------------------------|-----------------------|
| Working hrs. Per week..... | 42 / 40 | Work on weekends | Sometimes / Sometimes |
| Happy with W/L Balance..... | Yes / Yes | Take work home..... | Sometimes / Sometimes |

| Technology at work | a / b | | a / b |
|----------------------------|--------------------------------|---------------------------|----------------|
| Adopter type..... | Early Adopter / Early Majority | Website..... | Yes / Yes |
| Type of computer | Desktop / Desktop | Documents are scan'd..... | No / Yes |
| Internet connection..... | Broadband / Broadband | Emails are... .. | Mostly printed |
| Wireless network..... | Yes / Yes | | Rarely printed |
| E-mails vs. Fax..... | E-mails only / E-mails only | | |
| Type of monitors used..... | NR / Only Flat panel | | |

| | |
|---------------------|--|
| Technology at home: | a: Computer, Broadband / Wireless Connection |
|---------------------|--|

| AWW | a | b |
|--------------------------------------|--|----|
| a) Time flexibility..... | 2 | 1 |
| b) Place flexibility..... | 1 | 2 |
| c) Face-to-face interaction (4)..... | 1 | 2 |
| d) Bureaucracy level (3)..... | 2 | 1 |
| e) Competitiveness (2)..... | 3 | 3 |
| f) Computer dependency..... | 4 | 4 |
| g) Workstation dependency (4)..... | 1 | 1 |
| Hot-desking implemented..... | No | No |
| Preferred interaction space..... | Informal environment within the office (Cafeteria/kitchen) / Meeting rooms | |
| Teleworking option offered..... | No, I rather go to the office. / No, I rather go to the office. | |



| Frequency of variance (a/b) | |
|-----------------------------|-----------|
| Office environment: | 10 |
| Other: | 15 |
| Total: | 25 |

| Advantages of AWW | a | b | Disadvantages (AWW) | a | b |
|---------------------------------|---|---|-----------------------------|---|---|
| More free time..... | ✓ | ✓ | Isolation..... | ✓ | ✓ |
| Increased productivity..... | | | Longer working hrs..... | | |
| Less commuting time..... | ✓ | ✓ | Lack of motivation..... | ✓ | |
| Freeing up of office space..... | | | Lack of suitable environm't | ✓ | |
| More time with family..... | | | No boundaries H/W | ✓ | ✓ |

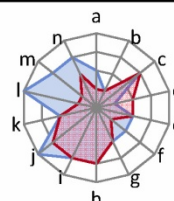
Commuting time (Return-min) (a/b).... 60 min by Car / 60 min by Public Transport

Questionnaire ID: CSB-04ab

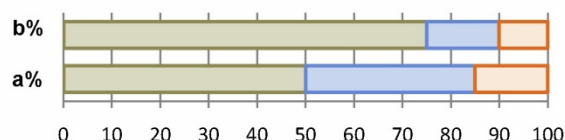
INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|------------|-------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | | Number of employees.... 21-40 |
| Respondent's: Age..... | 30's | Gender.... | F |

| Office Environment | a | b | a | b |
|-----------------------------------|---|---|---|---|
| a) Temperature comfort..... | 2 | 1 | 3 | 3 |
| b) Ventilation comfort..... | 1 | 1 | 3 | 3 |
| c) Illumination comfort..... | 3 | 3 | 4 | 3 |
| d) Noise comfort..... | 1 | 2 | 2 | 2 |
| e) Frequency of distractions..... | 2 | 2 | 4 | 1 |
| f) Visual privacy..... | 2 | 1 | 3 | 1 |
| g) Voice privacy..... | 2 | 2 | 3 | 2 |
| h) Spatial arrangement..... | 3 | 3 | | |
| i) Furniture arrangement..... | 3 | 3 | | |
| j) Office size..... | 4 | 3 | | |
| k) Office storage..... | 2 | 2 | | |
| l) Storage space..... | 4 | 1 | | |
| m) Space on workstation..... | 3 | 1 | | |
| n) Overall satisfaction..... | 3 | 2 | | |



| Type of work | a% | b% |
|--------------------------------|-----|-----|
| a) Individual Work..... | 50 | 75 |
| b) Face to Face..... | 35 | 15 |
| c) Building Relationships..... | 15 | 10 |
| | 100 | 100 |

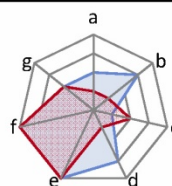


| Work / Life Balance | a / b | a / b |
|-----------------------------|---------|--|
| Working hrs. Per week..... | 45 / 45 | Work on weekends Sometimes / Sometimes |
| Happy with W/L Balance..... | No / No | Take work home..... Sometimes / Sometimes |

| Technology at work | a / b | a / b |
|----------------------------|---|-------------------------------------|
| Adopter type..... | Early Majority / Early Adopter | Website..... Yes / Yes |
| Type of computer | Desktop / Desktop | Documents are scan'd..... Yes / Yes |
| Internet connection..... | Broadband / Wireless | Emails are... Rarely printed |
| Wireless network..... | Yes / Yes | Mostly printed |
| E-mails vs. Fax..... | E-mails only / E-mails only | |
| Type of monitors used..... | Mostly Flat panel, some CRT / Mostly Flat panel, some CRT | |

| | |
|---------------------|---|
| Technology at home: | a: Computer, Printer, Broadband / Wireless Connection |
|---------------------|---|

| AWW | a | b |
|--------------------------------------|---|----|
| a) Time flexibility..... | 2 | 1 |
| b) Place flexibility..... | 3 | 1 |
| c) Face-to-face interaction (4)..... | 1 | 2 |
| d) Bureaucracy level (2)..... | 3 | 1 |
| e) Competitiveness (1)..... | 4 | 4 |
| f) Computer dependency..... | 4 | 4 |
| g) Workstation dependency (3)..... | 2 | 2 |
| Hot-desking implemented..... | No | No |
| Preferred interaction space..... | Each other's workstation / office / NR | |
| Teleworking option offered..... | No, but would like the option. / No, but would like the option. | |



| Frequency of variance (a/b) | |
|-----------------------------|-----------|
| Office environment: | 7 |
| Other: | 18 |
| Total: | 25 |

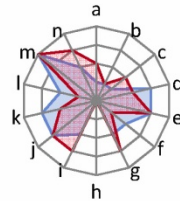
| Advantages of AWW | a | b | Disadvantages (AWW) | a | b |
|---------------------------------|---|---|-----------------------------|---|---|
| More free time..... | | ✓ | Isolation..... | | ✓ |
| Increased productivity..... | ✓ | ✓ | Longer working hrs..... | | |
| Less commuting time..... | ✓ | ✓ | Lack of motivation..... | ✓ | ✓ |
| Freeing up of office space..... | | | Lack of suitable environm't | ✓ | ✓ |
| More time with family..... | | ✓ | No boundaries H/W | ✓ | |

Commuting time (Return-min) (a/b).... 60 min by Foot / Bicycle / 50 min by Foot / Bicycle

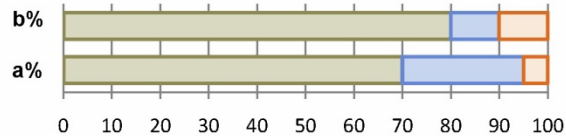
INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|------------|-------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | | Number of employees.... 21-40 |
| Respondent's: Age..... | 30's | Gender.... | M |

| Office Environment | a | b | | a | b |
|-----------------------------------|---|---|-------------------------------|---|---|
| a) Temperature comfort..... | 1 | 2 | h) Spatial arrangement..... | 0 | 0 |
| b) Ventilation comfort..... | 1 | 1 | i) Furniture arrangement..... | 2 | 3 |
| c) Illumination comfort..... | 1 | 2 | j) Office size..... | 3 | 3 |
| d) Noise comfort..... | 3 | 2 | k) Office storage..... | 3 | 2 |
| e) Frequency of distractions..... | 3 | 3 | l) Storage space..... | 2 | 1 |
| f) Visual privacy..... | 2 | 1 | m) Space on workstation..... | 4 | 4 |
| g) Voice privacy..... | 2 | 3 | n) Overall satisfaction..... | 2 | 3 |



| Type of work | a% | b% |
|--------------------------------|-----|-----|
| a) Individual Work..... | 70 | 80 |
| b) Face to Face..... | 25 | 10 |
| c) Building Relationships..... | 5 | 10 |
| | 100 | 100 |

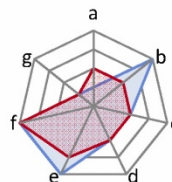


| Work / Life Balance | a / b | | a / b |
|-----------------------------|-----------|------------------------|------------------------|
| Working hrs. Per week..... | NR / 40 | Work on weekends | Sometimes / Sometimes |
| Happy with W/L Balance..... | Yes / Yes | Take work home..... | Frequently / Sometimes |

| Technology at work | a / b | | a / b |
|----------------------------|---|------------------------------|----------------|
| Adopter type..... | Early Majority / Early Majority | Website..... | Yes / Yes |
| Type of computer | Desktop / Desktop | Documents are scan'd..... | No / No |
| Internet connection..... | Broadband / Broadband | Emails are... Rarely printed | |
| Wireless network..... | No / Yes | | Mostly printed |
| E-mails vs. Fax..... | E-mails only / E-mails only | | |
| Type of monitors used..... | Only Flat panel / Mostly Flat panel, some CRT | | |

| | |
|---------------------|---|
| Technology at home: | a: Computer, Printer, Broadband / Wireless Connection |
|---------------------|---|

| AWW | a | b | |
|--------------------------------------|--|----|--|
| a) Time flexibility..... | 1 | 2 | |
| b) Place flexibility..... | 4 | 2 | |
| c) Face-to-face interaction (3)..... | 2 | 2 | |
| d) Bureaucracy level (3)..... | 2 | 2 | |
| e) Competitiveness (1)..... | 4 | 3 | |
| f) Computer dependency..... | 4 | 4 | |
| g) Workstation dependency (4)..... | 1 | 1 | |
| Hot-desking implemented..... | No | No | |
| Preferred interaction space..... | Meeting rooms / Informal environment within the office (Cafeteria/kitchen) | | |
| Teleworking option offered..... | No, but would like the option. / No, but would like the option. | | |



| Frequency of variance (a/b) | |
|-----------------------------|-----------|
| Office environment: | 9 |
| Other: | 19 |
| Total: | 28 |

| Advantages of AWW | a | b | Disadvantages (AWW) | a | b |
|---------------------------------|---|---|-----------------------------|---|---|
| More free time..... | | | Isolation..... | ✓ | |
| Increased productivity..... | ✓ | | Longer working hrs..... | ✓ | ✓ |
| Less commuting time..... | ✓ | ✓ | Lack of motivation..... | | |
| Freeing up of office space..... | | | Lack of suitable environm't | | |
| More time with family..... | | | No boundaries H/W | | ✓ |

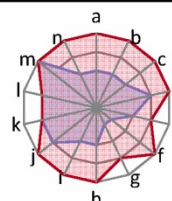
Commuting time (Return-min) (a/b).... 120 min by Car / 70 min by Car

Questionnaire ID: CSB-06ab

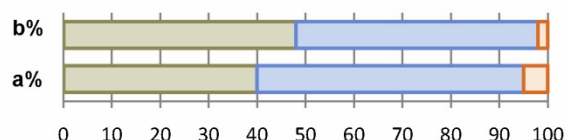
INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|------------------------|--|------------|-------------------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | | Number of employees.... 21-40 |
| Respondent's: Age..... | 40's | Gender.... | M |

| Office Environment | a | b | | a | b |
|-----------------------------------|---|---|-------------------------------|---|---|
| a) Temperature comfort..... | 2 | 4 | h) Spatial arrangement..... | 2 | 4 |
| b) Ventilation comfort..... | 2 | 4 | i) Furniture arrangement..... | 2 | 4 |
| c) Illumination comfort..... | 2 | 4 | j) Office size..... | 3 | 4 |
| d) Noise comfort..... | 3 | 4 | k) Office storage..... | 3 | 3 |
| e) Frequency of distractions..... | 2 | 3 | l) Storage space..... | 3 | 3 |
| f) Visual privacy..... | 1 | 4 | m) Space on workstation..... | 4 | 4 |
| g) Voice privacy..... | 1 | 3 | n) Overall satisfaction..... | 2 | 4 |



| Type of work | a% | b% |
|--------------------------------|-----|-----|
| a) Individual Work..... | 40 | 48 |
| b) Face to Face..... | 55 | 50 |
| c) Building Relationships..... | 5 | 2 |
| | 100 | 100 |

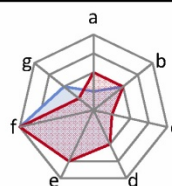


| Work / Life Balance | a / b | | a / b |
|-----------------------------|-----------|------------------------|-------------------------|
| Working hrs. Per week..... | 60 / 60 | Work on weekends | Frequently / Frequently |
| Happy with W/L Balance..... | Yes / Yes | Take work home..... | Frequently / Frequently |

| Technology at work | a / b | | a / b |
|----------------------------|---|------------------------------|----------------|
| Adopter type..... | Early Adopter / Early Majority | Website..... | Yes / Yes |
| Type of computer | Desktop / Desktop | Documents are scan'd..... | No / No |
| Internet connection..... | Wireless / Wireless | Emails are... Rarely printed | |
| Wireless network..... | Yes / Yes | | Rarely printed |
| E-mails vs. Fax..... | E-mails only / E-mails only | | |
| Type of monitors used..... | Mostly Flat panel, some CRT / Only Flat panel | | |

| | |
|---------------------|--|
| Technology at home: | a: Computer, Broadband / Wireless Connection |
|---------------------|--|

| AWW | a | b | |
|--------------------------------------|---|----|--|
| a) Time flexibility..... | 1 | 2 | |
| b) Place flexibility..... | 2 | 2 | |
| c) Face-to-face interaction (4)..... | 1 | 1 | |
| d) Bureaucracy level (3)..... | 2 | 2 | |
| e) Competitiveness (2)..... | 3 | 3 | |
| f) Computer dependency..... | 4 | 4 | |
| g) Workstation dependency (3)..... | 2 | 1 | |
| Hot-desking implemented..... | No | No | |
| Preferred interaction space..... | Each other's workstation / office / Each other's workstation / office | | |
| Teleworking option offered..... | / | | |



| Frequency of variance (a/b) | |
|-----------------------------|-----------|
| Office environment: | 11 |
| Other: | 11 |
| Total: | 22 |

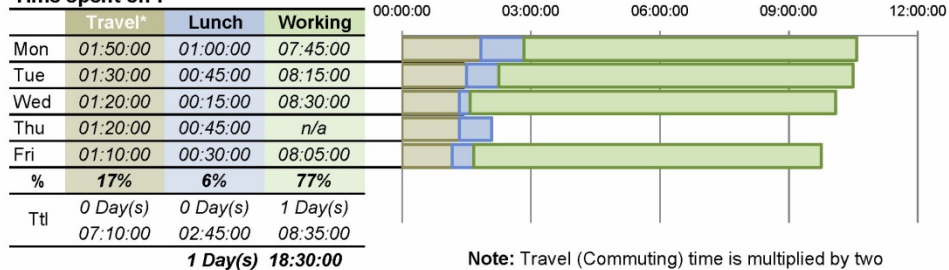
| Advantages of AWW | a | b | Disadvantages (AWW) | a | b |
|---------------------------------|---|---|-----------------------------|---|---|
| More free time..... | ✓ | ✓ | Isolation..... | ✓ | |
| Increased productivity..... | | | Longer working hrs..... | | |
| Less commuting time..... | ✓ | ✓ | Lack of motivation..... | | |
| Freeing up of office space..... | | | Lack of suitable environm't | ✓ | ✓ |
| More time with family..... | ✓ | ✓ | No boundaries H/W | | |

Commuting time (Return-min) (a/b).... 45 min by Public Transport / 90 min by Public Transport

Work Sampling Diary: CSB-01a

WORK SAMPLING DIARY REPORT

Time spent on :

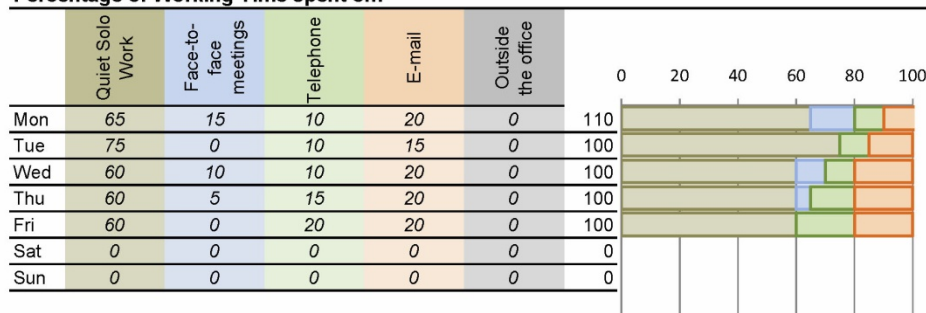


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

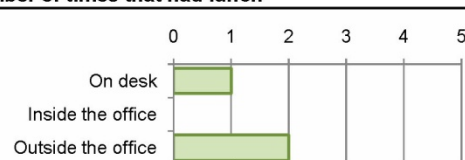
Percentage of Working Time spent on:



Could have done today's work from outside the office

| Could have done today's work from outside the office | Took work home |
|--|----------------|
| Mon 3 | No |
| Tue 3 | No |
| Wed n/a | No |
| Thu n/a | n/a |
| Fri n/a | No |

Number of times that had lunch



Week representativeness:

This was a quiet week in comparison to most for me due to the office move and the start of main mail we were fairly quiet it is the calm before the storm I feel.

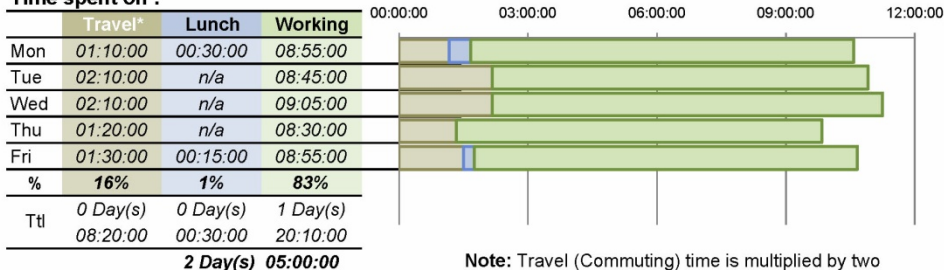
Comments:

MON: Had to go to the client's office first thing to pick things up. Briefs to write for a upcoming job. Fairly quiet not too many phone calls. | TUE: Today was spent sorting invoicing and checking copy for a big job. Artwork was busy today | WED: Sorted the office for the office move. Briefed creatives for main mail. Focused on two flyers and stationary that had to go to print. | THU: Sent stationary and two flyers to print. Checked covers for main mail. | FRI: Today was the last day in our old office so most of the day was spent sorting stuff out. Checking main mail. Sent flyer that didn't go to print. | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-01b

WORK SAMPLING DIARY REPORT

Time spent on :

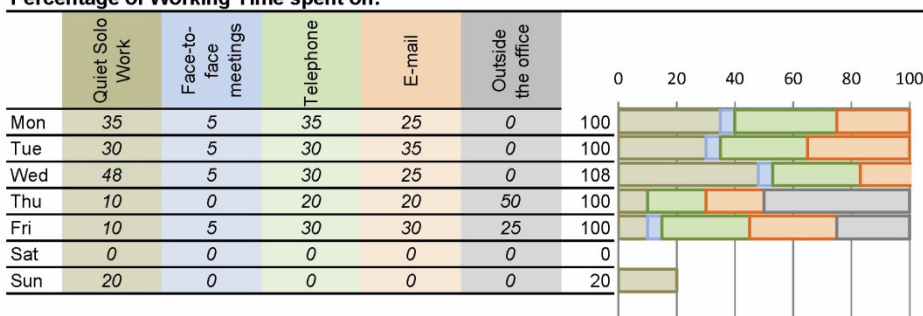


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



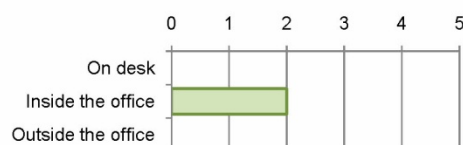
Could have done today's work from outside the office

| | |
|-----|---|
| Mon | 2 |
| Tue | 2 |
| Wed | 2 |
| Thu | 2 |
| Fri | 2 |

Took work home

| | |
|-----|-----|
| Mon | No |
| Tue | No |
| Wed | No |
| Thu | No |
| Fri | Yes |

Number of times that had lunch



Week representativeness:

This week was pretty representative of an average week at work. Maybe slightly busier. We picked up a large amount of work this week.

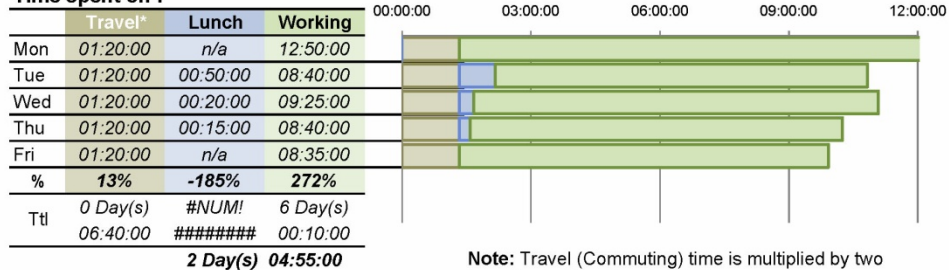
Comments:

MON: Wrote briefs for late work for main mail including premier mail page 2. Traffic for many of the main mail components. Took shoe tailor film. And ensured those were edited. | TUE: Briefed in creative changes to main mail. Put together a facebook presentation and competitors review to present to a client for a ??? Facebook page. Traffic main mail amends. Sorted outstanding invoices. | WED: Completed facebook competitor review. Finished invoicing. Traffic main mail amends. Sorted a blog problem. Had a web 2.0 meeting. | THU: Traffic main mail amends. 1:00 to 2:00 meeting with client to talk about developing a facebook page. Picked up recruitment briefs for 3 recruitment brands and discussed last years campaigns. Picked up amends for main mail. | FRI: Traffic main mail amends. Picked up two briefs. Wrote contact report for web 2.0 meeting. Picked up fashion world stationary brief. Wrote brief for stationary. | SAT: 0 | SUN: Wrote outstanding briefs for two brands. | OVERALL: 0

Work Sampling Diary: CSB-02a

WORK SAMPLING DIARY REPORT

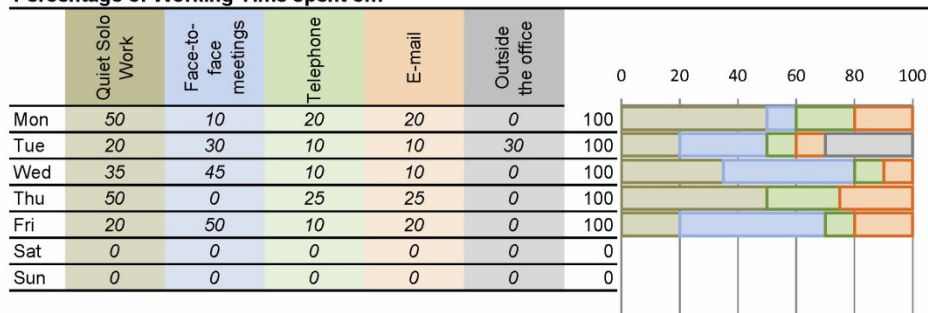
Time spent on :



Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



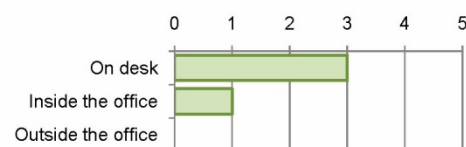
Could have done today's work from outside the office

Mon n/a
Tue 2
Wed 3
Thu 4
Fri 2

Took work home

No
Yes
Yes
n/a
No

Number of times that had lunch



Week representativeness:

Fairly unusual week as we were packing for moving office.

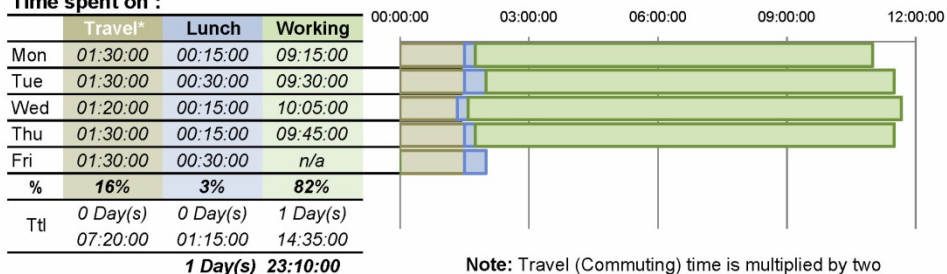
Comments:

MON: Mostly working on client presentation and creative amends | TUE: Client meeting | WED: Client meeting which took most of the afternoon | THU: Left work early | FRI: Packed up office for move | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-02b

WORK SAMPLING DIARY REPORT

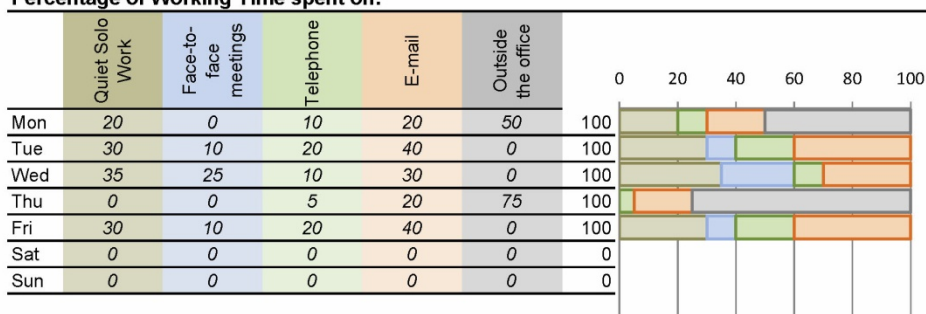
Time spent on :



Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



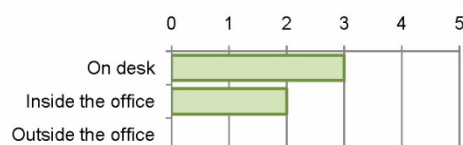
Could have done today's work from outside the office

Mon 1
Tue 3
Wed 3
Thu 1
Fri n/a

Took work home

No
No
No
No
n/a

Number of times that had lunch



Week representativeness:

Had two photo shoots which is fairly unusual, meaning time spent in the office was busier than normal.

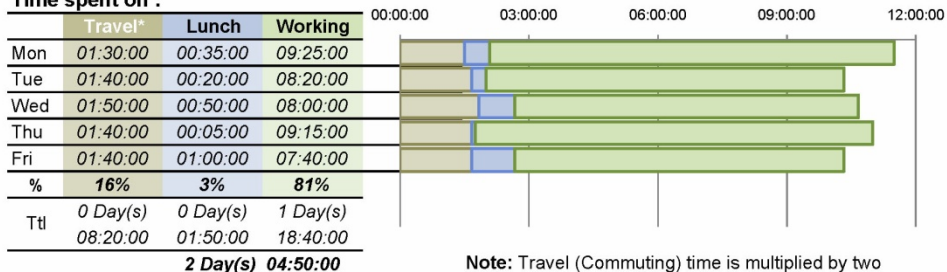
Comments:

MON: At photo shoot for most of morning | TUE: Two conference calls. Mainly trafficking amends. | WED: Average day. Client meeting in afternoon. | THU: At photo shoot outside of the office for most of the day. | FRI: Normal day in office. | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-03a

WORK SAMPLING DIARY REPORT

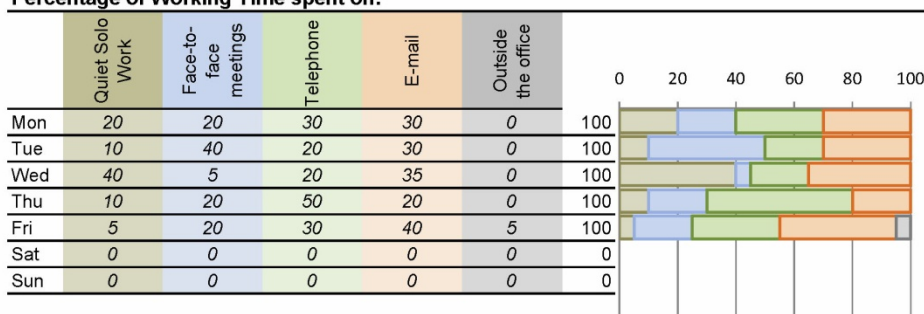
Time spent on :



Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



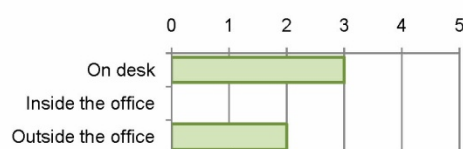
Could have done today's work from outside the office

Mon 1
Tue na
Wed 3
Thu 1
Fri 1

Took work home

Yes
Yes
No
No
No

Number of times that had lunch



Week representativeness:

This week was a bit different as we were moving offices, but apart from that the client work was very similar to most weeks.

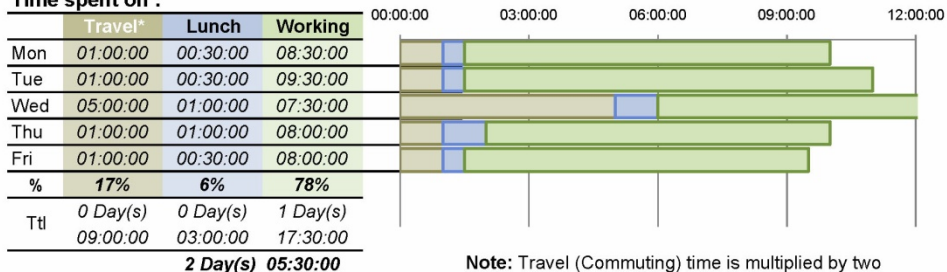
Comments:

MON: Had a lot to catch up with after being out of office on Friday and sending PMI email - lots to organise | TUE: Sending out PMI email. Fixing problems with the reporting organising over the phone and mail. | WED: Spent a lot of the day chasing a client for sign off and sorting out invoices for PMI. | THU: Had a lot of problems with an advert so had to do a lot of amends and persuasion with studio to get them done and the paper to extend deadlines | FRI: Spent the day getting a variety of work amended and sending it over to clients. Proportion of the day was also spent setting up the new office. | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-03b

WORK SAMPLING DIARY REPORT

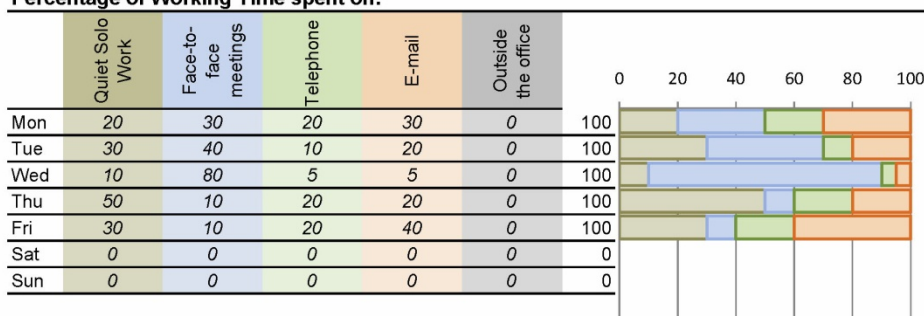
Time spent on :



Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



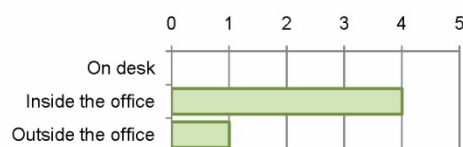
Could have done today's work from outside the office

Mon 2
Tue 1
Wed 1
Thu 3
Fri 1

Took work home

No
No
No
No
No

Number of times that had lunch



Week representativeness:

n/a

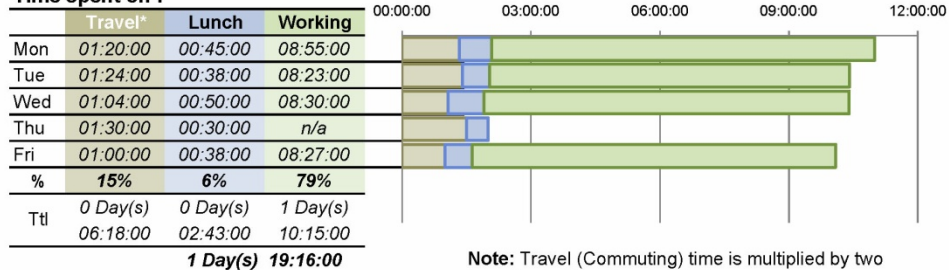
Comments:

MON: Spent day putting together everything needed following the PMI monthly and sending things through to PMI | TUE: Spent some time in the Power Point training and then preparing for the landscape center Pitch. Included meetings with suppliers for the pitch. | WED: At the landscape center pitch and arrived back in the office at 4pm to catch up on work and do the follow up email brief for essential genius. | THU: Spent the day doing lots of briefs and quotes for upcoming PMI work. | FRI: Spent the day following up on quotes and briefs for upcoming work. Organising a lot of CWDC and PMI amends. | SAT: 0 | SUN: 0 | OVERALL: n/a

Work Sampling Diary: CSB-04a

WORK SAMPLING DIARY REPORT

Time spent on :

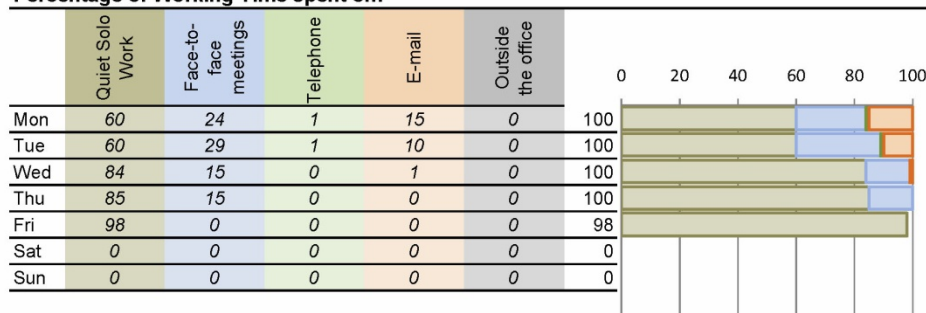


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



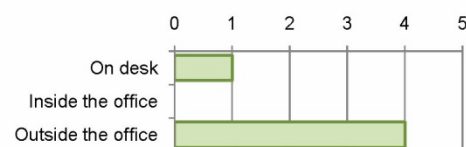
Could have done today's work from outside the office

Mon 2
Tue 1
Wed 2
Thu 1
Fri 3

Took work home

No
No
No
Yes
No

Number of times that had lunch



Week representativeness:

Concerning work load, arriving and leaving times, interruptions etc it was an average week; just slightly more chaotic because of the move.

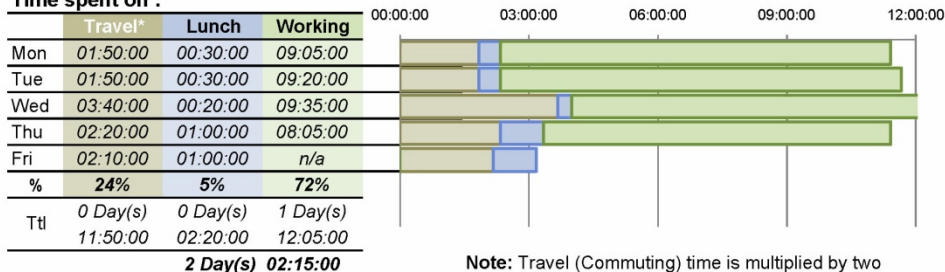
Comments:

MON: Long wait for briefing. Briefing a bit rushed with no supervisor. A lot of interruptions thought the day, so didn't make much progress with scheduled day's work. Not very satisfied with myself. | TUE: Busy morning. Jobs coming back to ????. Lots of small things piling up. Many interruptions, things bouncing back. | WED: Let's see what the day brings... So far: small design job. Struggled a bit as with that client you can't be too ????. Lots of amends. There seems to be no end. Heating my job today. Can't do anything right. | THU: Moving office, so chaos. Internet isn't working got no emails and no ????. Stress! Got to do ????, no idea how.. Thank goodness for web tutorials. It will sort itself... I hope. Crush time - gotta take work home. | FRI: So far so good...building, building, building and more building. Fairly quiet today, fingers crossed. Busy, but not stressed...yet. So many email-builds, sooo boring. Dragging day | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-04b

WORK SAMPLING DIARY REPORT

Time spent on :

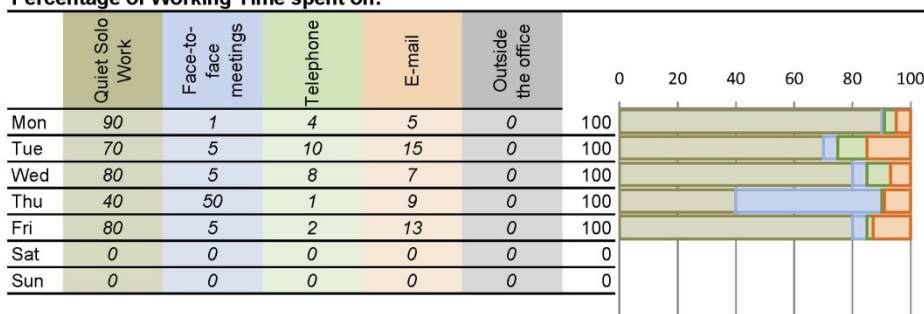


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



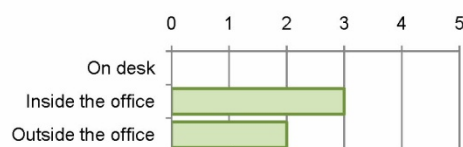
Could have done today's work from outside the office

Mon 4
Tue 2
Wed 2
Thu 1
Fri 1

Took work home

No
No
No
No
n/a

Number of times that had lunch



Week representativeness:

It was an average week. The only unusual thing was being in the new office and settling in. Workload wise it was the same as always.

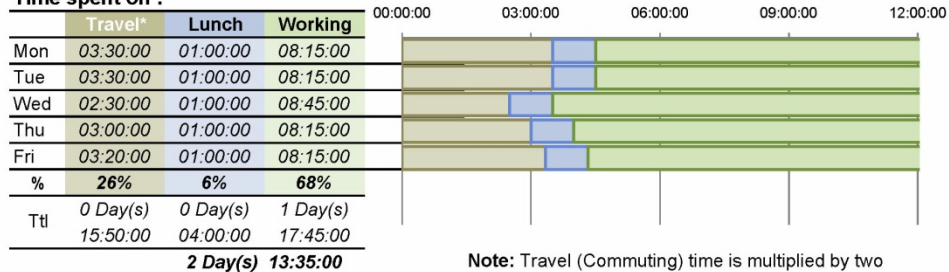
Comments:

MON: Boss is in a witch-hunt about desk tidiness and eating on our desk. Feels like he's desperate to catch us out and just waiting to have a go. Oh well, 10 more months... | TUE: Basically wasted a full days work because account ?? Gave me and another the same job. Even after I asked them to check. | WED: Productive day. Loads of different things. Hope they were happy with the html version of the blog I spend all last week building at home after hours. | THU: The "keep-the-office-tidy, don't eat-on-your-desk, no-books-et-on-desktop, I-love-minimalistic-witch-hunt is being continued. Good workshop about SEC this morning. Enjoyed that! | FRI: Someone else used my computer last night and didn't switch it off. So now I am in trouble for it. After I've just been yesterday for not tidying my desk. Thinking about resigning more every day. But currently it is better to keep the job you have I guess. | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-05a

WORK SAMPLING DIARY REPORT

Time spent on :

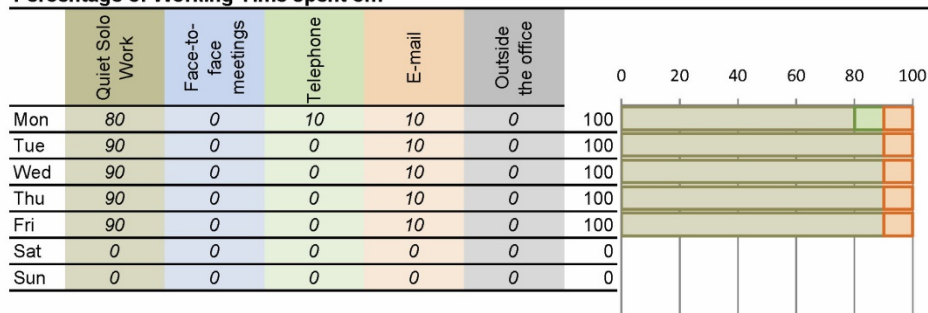


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:

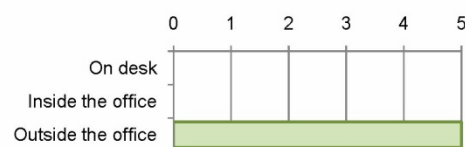


Could have done today's work from outside the office

| | | |
|-----|-----|----|
| Mon | 3 | No |
| Tue | 3 | No |
| Wed | 3 | No |
| Thu | n/a | No |
| Fri | n/a | No |

Took work home

Number of times that had lunch



Week representativeness:

This was a typical work not too many meetings with a busy schedule to keep me busy. Possibly could have worked from home on a couple of the days.

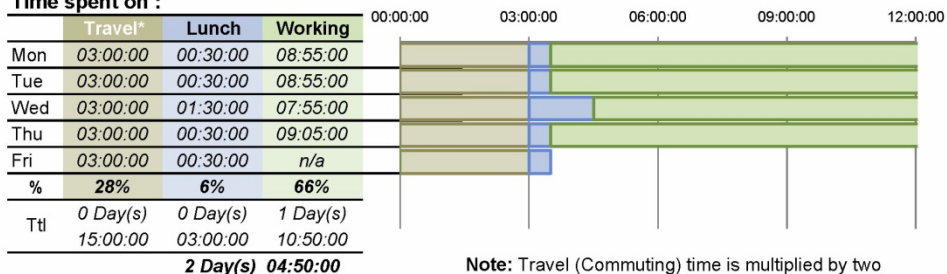
Comments:

MON: n/a | TUE: n/a | WED: n/a | THU: n/a | FRI: n/a | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-05b

WORK SAMPLING DIARY REPORT

Time spent on :

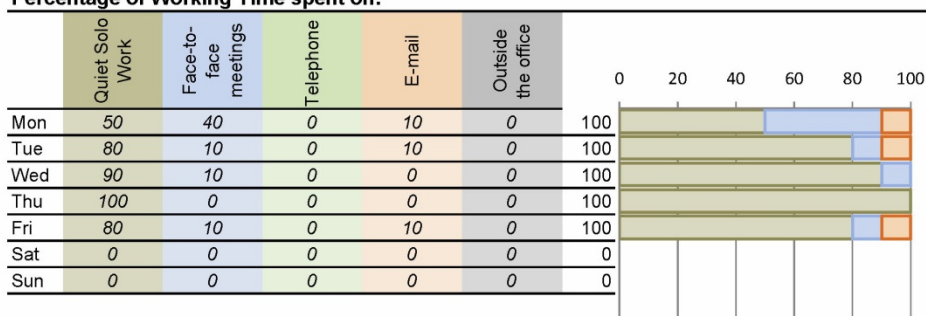


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 0:00:00 From n/a

Percentage of Working Time spent on:

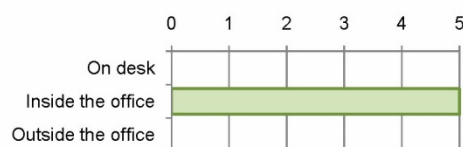


Could have done today's work from outside the office

Took work home

| | | |
|-----|---|----|
| Mon | 1 | No |
| Tue | 1 | No |
| Wed | 1 | No |
| Thu | 1 | No |
| Fri | 1 | No |

Number of times that had lunch



Week representativeness:

This was a good representative of a typical week at the office.

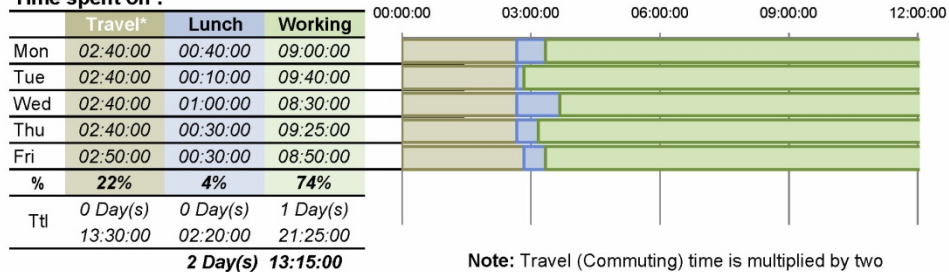
Comments:

MON: Spent time conceptualizing today. | TUE: n/a | WED: n/a | THU: A busy day with deadlines to meet. | FRI: n/a | SAT: 0 | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-06a

WORK SAMPLING DIARY REPORT

Time spent on :

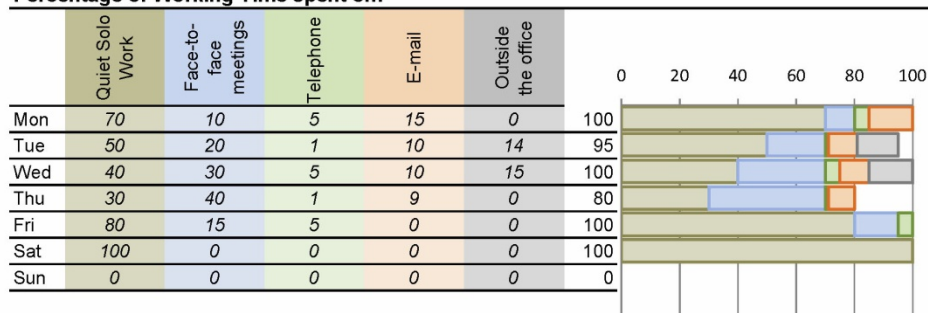


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 2hrs From Home
Sun 0:00:00 From n/a

Percentage of Working Time spent on:



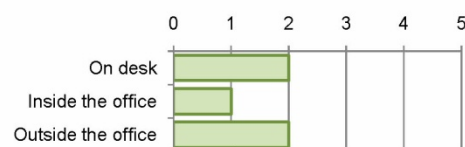
Could have done today's work from outside the office

Mon 2
Tue 1
Wed 1
Thu 1
Fri 2

Took work home

No
Yes
No
No
Yes

Number of times that had lunch



Week representativeness:

Not very, mostly because i spent time out of the office to help with the office move.

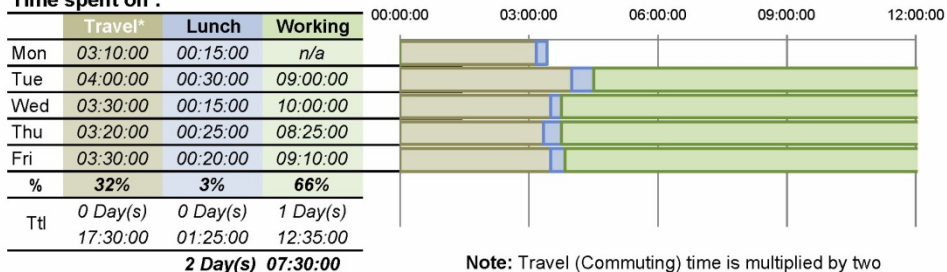
Comments:

MON: Not a typical day as had some work put back and helped to pack for the office move. | TUE: Going to new office to move items today. | WED: Helping with office move, and brainstorm and Mac work. | THU: Mostly Mac and conceptual work. | FRI: Mostly Mac work and attending briefing. | SAT: Worked on speculative work concept and read brief for next week. | SUN: 0 | OVERALL: 0

Work Sampling Diary: CSB-06b

WORK SAMPLING DIARY REPORT

Time spent on :

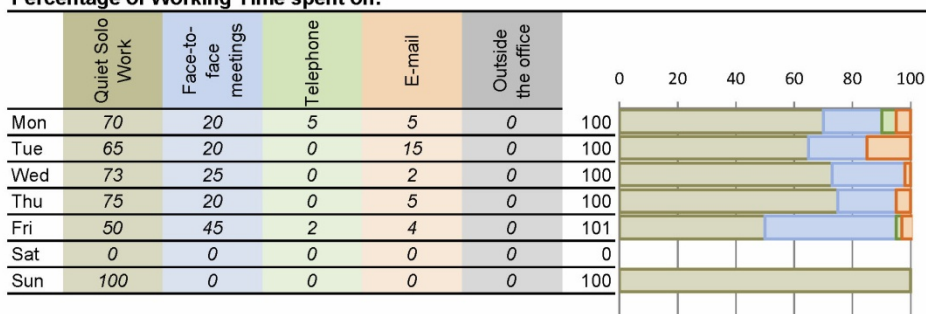


Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

Sat 0:00:00 From n/a
Sun 2hrs From Home

Percentage of Working Time spent on:



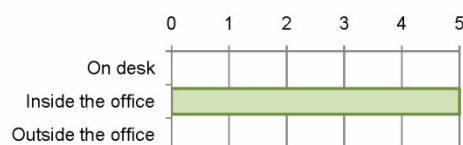
Could have done today's work from outside the office

Mon 1
Tue 1
Wed 1
Thu 1
Fri 1

Took work home

No
Yes
No
Yes
Yes

Number of times that had lunch



Week representativeness:

Fairly representative

Comments:

MON: Mac work and attending briefing with freelancers | TUE: Train cancelled this morning, in late. | WED: Lunch time brainstorm on Christmas card and after work. | THU: Mostly Mac work today | FRI: Conceptual and design work on the mac and sitting in a briefing | SAT: 0 | SUN: Worked on Lakeland Christmas email project and read through Bupa brief for next week. | OVERALL: 0

Appendix 10a

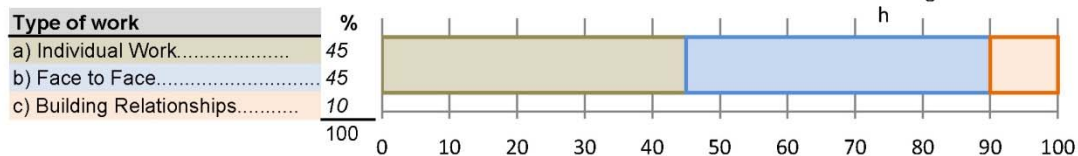
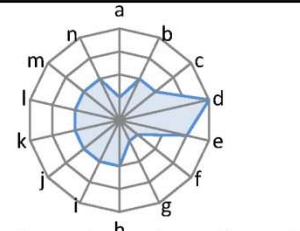
Survey and WSD Reports

INDIVIDUAL QUESTIONNAIRE REPORT

| | | | |
|-----------------------|--|-------------------------|-----------------------|
| Type of Building..... | Office building or building designed for the organisation's activities | | |
| Layout..... | Open-plan | Number of employees.... | 151+ |
| Respondent's: | Age..... 30's | Gender.... F | Position..... Manager |

Office Environment

| | | | |
|-----------------------------------|---|-------------------------------|---|
| a) Temperature comfort..... | 1 | h) Spatial arrangement..... | 2 |
| b) Ventilation comfort..... | 2 | i) Furniture arrangement..... | 2 |
| c) Illumination comfort..... | 2 | j) Office size..... | 2 |
| d) Noise comfort..... | 4 | k) Office storage..... | 2 |
| e) Frequency of distractions..... | 3 | l) Storage space..... | 2 |
| f) Visual privacy..... | 1 | m) Space on workstation..... | 2 |
| g) Voice privacy..... | 1 | n) Overall satisfaction..... | 2 |



Work / Life Balance

| | | | |
|-----------------------------|-----|-----------------------|-----------|
| Working hrs. Per week..... | 25 | Work on weekends..... | Never |
| Happy with W/L Balance..... | Yes | Take work home..... | Sometimes |

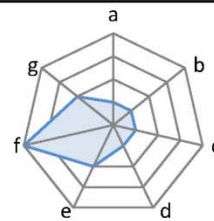
Technology at work

| | | | |
|----------------------------|------------------------|----------------------------|----------------|
| Adopter type..... | Laggard | Company has a website..... | Yes |
| Type of computer..... | Desktop / non-portable | Documents are scanned..... | Yes |
| Internet connection..... | Broadband | E-mails are..... | Rarely printed |
| Wireless network..... | No | | |
| E-mails vs. Fax..... | E-mails only | | |
| Type of monitors used..... | Only Flat panel | | |

Technology at home: Computer, Printer, Broadband / Wireless Connection

Alternative Ways of Working (AWW)

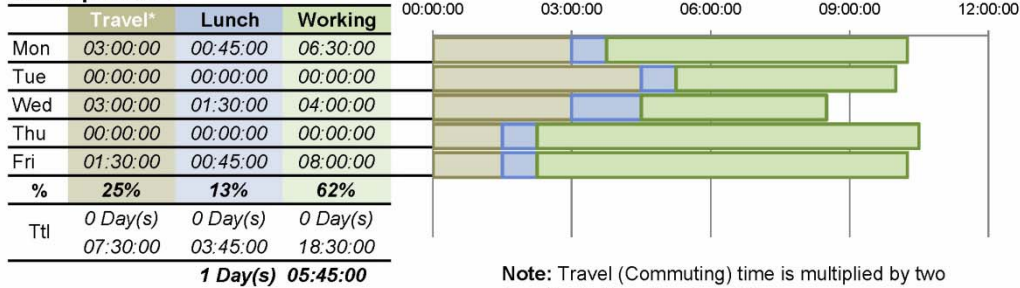
| | |
|--------------------------------------|---|
| a) Time flexibility..... | 1 |
| b) Place flexibility..... | 1 |
| c) Face-to-face interaction (4)..... | 1 |
| d) Bureaucracy level (4)..... | 1 |
| e) Competitiveness (3)..... | 2 |
| f) Computer dependency..... | 4 |
| g) Workstation dependency (3)..... | 2 |
| Hot-desking implemented..... | Yes |
| Preferred interaction space..... | Meeting rooms |
| Teleworking option offered..... | Yes, but I do not use this option, I rather go to the office. |
| 'Green' policies in place..... | *Refer to Case Study description |



Perceived advantages of AWW

| Perceived advantages of AWW | Perceived disadvantages (AWW) |
|---------------------------------|-----------------------------------|
| More free time..... | Isolation..... |
| Increased productivity..... | Longer working hrs..... |
| Less commuting time..... | Lack of motivation..... |
| Freeing up of office space..... | Lack of suitable environment..... |
| More time with family..... | No boundaries Home/Work..... |

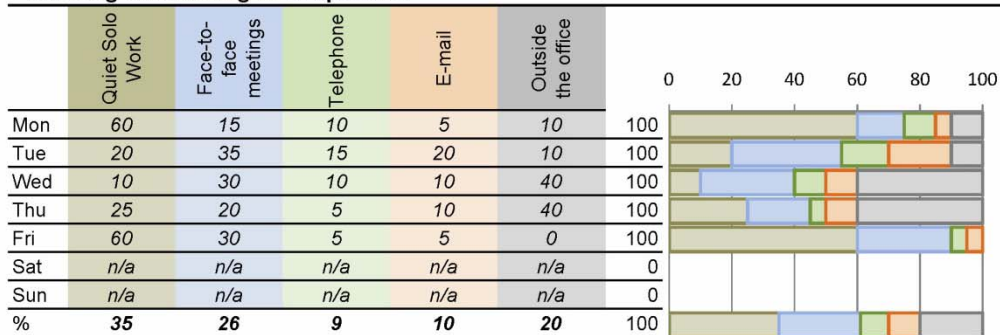
Commuting time (Return-min)..... 180 min by Car
Office located in: *Refer to Case Study description

Work Sampling Diary: **CSC-01****WORK SAMPLING DIARY REPORT****Time spent on :**

Note: Travel (Commuting) time is multiplied by two to estimate the return travel time.

Hours worked on weekend

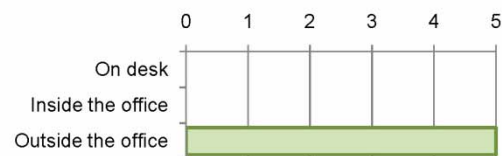
Sat n/a
Sun n/a

Percentage of Working Time spent on:**Could have done today's work from outside the office**

Mon 3
Tue 1
Wed 3
Thu 3
Fri 3

Took work home

No
No
No
n/a
No

Number of times that had lunch**Week representativeness:**

Good representation of an average week

Comments:

MON: Had meeting at 9:30 am on my way to work. Had seminar (Work related) after work 6PM - 8PM | TUE: Had meeting at 9am on my way to work. Had a meeting after work at 4:30 pm on my way home. | WED: Had 8:30AM meeting on the way to work. Had 3:30 PM Meeting on the way home from work. | THU: Had a meeting at 10AM in the city | FRI: No Comments | SAT: n/a | SUN: n/a | OVERALL: No Comments

Compilation of results

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SURVEY RESULTS

Demographics (S.1 to S.7)

- S.1** The majority of respondents (64%) are males.
-
- S.2** The majority of respondents (54%) belong to Generation X, followed by the Baby Boomers generation (38%). Only 8% of respondents belong to Generation Y.
-
- S.3** The majority of respondents (57%) work in companies of 1-10 employees.
-
- S.4** Most of the respondents (72%) work in a Small company (20 or less employees), followed by 15% working in a Medium company (21 to 99 employees). The remaining 13% work in Large companies (100+ employees).
-
- S.5** Almost all large companies (92%) prefer a city location. The majority of small companies (57%) tend to be located in the suburbs. Medium companies are equally divided (50%) between city and suburb locations.
-
- S.6** Most of the respondents (80%) belong to a Senior Management (SM) position.
-
- S.7** Designers in senior management positions (A|SM) represent 37% of the respondents. Designers in other positions (A|O) represent 8% of the respondents. Accountants in senior management positions (B|SM) represent 43% of the respondents. Accountants in other positions (B|O) represent 12% of the respondents.
-

Office environment (S.8 to S.31)

- S.8** Most of the companies (75%) are hosted in purpose designed buildings. A quarter (25%) of the companies are hosted in adapted spaces, composed by 8% in adapted home/apartment units and 17% in adapted warehouse or other non-office building.
-
- S.9** All (100%) offices hosted in Adapted home / apartment unit are located in the Suburbs. The majority (59%) of the offices hosted in adapted warehouse or other non-office building are located in the Suburbs. The majority (55%) of the offices hosted in an office building or building designed for the organisation's activities are located in the City.
-
- S.10** Parameter 'j) General office size' reported the highest number of respondents satisfied (90%). On the other hand, the majority of respondents (54%) were unsatisfied with 'g) Voice privacy' which reported the lowest level of satisfaction in the study. Parameter 'j) Office space' registered the highest percentage (90%) of satisfied respondents. Almost all respondents (88%) considered parameter 'n) Overall space environment' satisfactory. Parameters 'a) Temperature' and 'b) Ventilation' ranked below 'c) Illumination' satisfaction, but above 'd) Noise level', 'e) Distractions' and 'f) Privacy'.
-
- S.11** With the exception of 'g) voice privacy', the level of office environment satisfaction is satisfactory across all respondents.
-

| | |
|-------------|--|
| S.12 | Parameters 'i) Furniture arrangement' and 'n) overall satisfaction' have the highest correlation coefficient (0.7429) not only between environment parameters, but across all other variables. |
| S.13 | There is a high correlation (0.7310) between 'f) Visual privacy' and 'g) Voice privacy' parameters. |
| S.14 | 'a)Temperature' and 'b)Ventilation' parameters have a correlation coefficient of 0.7172. |
| S.15 | Overall, spatial parameters (h-m) ranked better than environment comfort and privacy parameters (a-g). |
| S.16 | Enclosed layouts ranked better (by 10%) than open layouts at temperature comfort. |
| S.17 | Adapted buildings ranked better (by 24%) than purpose designed buildings at ventilation comfort. |
| S.18 | Purpose designed buildings ranked better (by 14%) than adapted buildings at illumination. |
| S.19 | Adapted buildings ranked better (by 10%) than purpose designed buildings at frequency of distractions. |
| S.20 | Enclosed layouts ranked better (by 39%) than open layouts at visual privacy. |
| S.21 | Enclosed layouts ranked better (by 44%) than open layouts at voice privacy. |
| S.22 | Adapted buildings ranked better (by 10%) than purpose designed buildings at spatial arrangement. |
| S.23 | Enclosed layouts ranked better (by 11%) than open layouts at spatial arrangement. |
| S.24 | Overall, adapted buildings and enclosed layouts outperformed purpose designed buildings and open layouts. |
| S.25 | Visual and voice privacy ranked better in enclosed layouts than open layouts. |
| S.26 | Open plan is the most typical (54%) office layout. |
| S.27 | Most of the offices (75%) hosted in adapted residential buildings have enclosed layouts. |
| S.28 | Most of the offices (88%) hosted in adapted non-residential buildings have open-plan layouts. |
| S.29 | Half of the offices (50%) hosted in purpose designed buildings have open-plan layouts. |
| S.30 | The majority of organisations (67%) with 11 or more employees have open-plan layouts. Whereas, less than half (45%) organisations with 1-10 employees have open-plan layouts. |
| S.31 | Most of the Designers (74%) have an open-plan layout. On the other hand, the majority of Accountants (51%) have an enclosed layout. |

Work habits (S.32 to S.78)

| | |
|-------------|--|
| S.32 | Most of the respondents (85%) work overtime (37.5+ h.p.w). Only 4% of respondents work a standard week (37.5 h.p.w). Part-time or casual employees represented 11% of the respondents. |
| S.33 | On average Designers work more hours per week than Accountants. However, some Accountants (3) work more hours per week than the Designer working the most hours. |
| S.34 | The respondent's position (SM/O) influences the amount of hours worked per week more than the profession (A/B) they belong to. |
| S.35 | Respondents grouped under Senior Management are likely to work more hours per week than respondents in Other positions. |
| S.36 | The majority of respondents (63%) take work home occasionally. Almost a quarter of respondents (24%) never take work home, whilst 9% take work home every day. |
| S.37 | The majority of respondents (60% to 75%, depending on the profession and position subgroup) take work home occasionally. |
| S.38 | The frequency by which respondents take work home is influenced more by their position than by their profession. |
| S.39 | Senior management respondents are more likely to take work home than respondents in other positions. |
| S.40 | The majority of respondents (68%) occasionally work on weekends. Over a quarter of respondents (27%) never work on weekends, whilst 5% work every weekend. |
| S.41 | Senior management respondents are more likely to work on weekends than respondents in other positions. |
| S.42 | Overall, senior management respondents are more likely to work longer hours and more frequently take work home and work on weekends than respondents in other positions. |
| S.43 | Most respondents (72%) are happy with their work/life balance. |
| S.44 | The highest percentage of respondents (85%) that is satisfied with their work/life balance is in the 37.6 to 40 working hours per week range. |
| S.45 | The majority of respondents (55%) working 55 to 60 hours per week are still happy with their work/life balance. |
| S.46 | The two respondents working 71 to 75 hours per week are satisfied with their work/life balance. |
| S.47 | The only respondent working up to 80 hours per week (the highest range) is unsatisfied with his work/life balance. |

| | |
|-------------|--|
| S.48 | The percentage of respondents (75%) that work the standard working hours (37.5) per week and are satisfied with their work/life balance is lower than the percentage of respondents (83%) working up to 45 hours per week. |
| S.49 | Most of the respondents (79%) that never take work home are satisfied with their work/life balance. The percentage of satisfaction decreases to 74% as respondents occasionally take work home. However, taking work home every day considerably lowers the percentage of respondents (30%) that are happy with their work/life balance. |
| S.50 | All of the respondents (4) that work from home are satisfied with their work/life balance. |
| S.51 | Most of the respondents (85%) that never work on weekends were satisfied with their work/life balance. This percentage declined as the frequency of working on weekends increased (Scale 2=73%, Scale 3=67%). Working every weekend considerably lowers the percentage (17%) of respondents that are happy with their work/life balance. |
| S.52 | Working on weekends affects the respondents' work/life balance satisfaction more than taking work home. |
| S.53 | The percentage of respondents that are happy with their work/life balance (A O=75%, B O=92%) in the other position group is higher than the senior management group (A SM=71%, B SM=67%) and above the percentage obtained across all respondents (72%). |
| S.54 | Almost all (94%) of the respondents are commonly at their workstation. The majority (58%) are most of the time (scale 4) at their workstation. |
| S.55 | There are no respondents that are rarely at their workstation (scale 1). |
| S.56 | The majority (4 out of 6 respondents) with low workstation dependency are accountants, all belong to the senior management group, but vary in their detailed position (3 directors, 2 managers, and 1 partner). Half work 50 hours per week. Half of them spend most of their time doing individual work, two doing face-to-face collaboration and one spends 100% of her time at the office building relationships. |
| S.57 | The range '80-89%' of working time accumulates the highest percentage of respondents (24%) working in individual work and quiet thinking mode. Most of the respondents (65%) spend 60% or more of their time working in this mode. A tenth (10%) of respondents work in this mode 90-100% of their time. |
| S.58 | Most of the respondents (58%) spend between 10% to 29% of their time (two ranges) working in face-to-face collaboration mode. Few respondents (3%) spend 60-69% of their time in this mode. None of the respondents spend more than 69% of their time in this working mode. |
| S.59 | The highest percentage of respondents (30%) working in building relationships and socialising mode concentrated in a single range happens in range 1-9%. The majority of respondents (57%) work in this mode up to 19% of their time. This working mode has the highest percentage (8%) of respondents not working in this mode. However, one respondent works in this mode 100% of the time. |

Appendix 11a

| | |
|-------------|---|
| S.60 | The representative percentage of time spend across all respondents in individual work and quite thinking is 67%, face-to-face collaboration 22% and building relationships and socialising 11%. |
| S.61 | Designers (A SM=40%, A O=25%) spend more time than accountants (B SM=31%, B O=25%) doing individual work and quiet thinking in the 80-100% range. |
| S.62 | Senior management (A SM=40%, B SM=31%) spends more time than other (A O=25%, B O=25) positions doing individual work and quiet thinking in the 80-100% range. |
| S.63 | Senior management across professions (A SM=3%, B SM=4%) is the only sub-group represented in the 60-79% range of time working in face-to-face collaboration mode. This range is the highest reported for this working mode. |
| S.64 | Designers are more likely to spend more time building relationships and socialising than accountants. |
| S.65 | Designers at senior management level (A SM) are the only sub-group represented spending over 60% of time building relationships and socialising. |
| S.66 | Almost all (92%) work related interaction is done somewhere inside the office environment. |
| S.67 | Most of the respondents (64%) prefer each other's workstation/office over meeting rooms (26%) for work related interaction. |
| S.68 | More respondents (8%) prefer environments outside the office over informal environments within the office (3%) for work related interaction. |
| S.69 | Performing work related interaction somewhere outside the office is preferred by more designers than accountants. |
| S.70 | For most respondents (77%) face-to-face interaction is necessary as part of their daily activities. For 32% of this group, it is essential (scale 4). |
| S.71 | There are no differences in the importance of face-to-face interaction in terms of profession or position held. |
| S.72 | Respondents that consider face-to-face interaction unnecessary for their daily activities (scale 1) have a lower percentage of face-to-face collaboration working mode than the calculated average. These respondents are also likely to work in small companies or be sole practitioners, and work either in a home based office or work at home at least once per week. |
| S.73 | All respondents (100%) have at least one computer at work. |
| S.74 | The majority (61%) of respondents have a desktop computer only. Some (32%) of the respondents have a laptop only. Few (7%) have both. |
| S.75 | Respondents in senior management positions are more likely than respondents in other positions to have laptops. |

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| S.76 | Designers in other positions [A O] are more likely to have a desktop than any other sub-group. |
| S.77 | Almost all (95%) respondents depend on a computer to do their job. From this group 90% could not do their work without a computer (scale 4). |
| S.78 | It is inconclusive why some respondents (3) consider that they do not require a computer to do their work. |

Organisation context (S.79 to S.107)

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| S.79 | The majority (54%) of the respondents consider their organisations to be flexible about when employees do their work. From this group, 19% of the organisations allow employees to choose when to work as long as they meet their target. |
| S.80 | Companies with 1-10 employees tend to be more flexible about when employees do their work than companies with 11+ employees. |
| S.81 | Designers tend to be more flexible about when employees do their work than accountants. |
| S.82 | Most of the respondents (73%) consider their organisation to be inflexible about where employees do their work. |
| S.83 | Organisations are more flexible about the time (when) work is done than the place (where) it is done. |
| S.84 | Designers tend to be less flexible about where employees do their work than accountants. |
| S.85 | In terms of company size it is inconclusive which group (1-10 employees/11 or more) is less flexible about when employees do their work. |
| S.86 | Accountants with 1-10 employees are the most flexible group about where employees do their work. |
| S.87 | Respondents tend to rank place flexibility equally or less flexible than time. |
| S.88 | The majority of the respondents (61%) consider their organisations to be relaxed about following procedures (low level of bureaucracy). From this group, 27% considers procedures to be relaxed (scale 1). |
| S.89 | Companies with 1-10 employees tend to be more relaxed than larger companies in their procedures (less bureaucratic). |
| S.90 | Designers tend to be more relaxed in their procedures (less bureaucratic) than accountants. |
| S.91 | The majority of respondents (71%) consider their organisation to have low interpersonal competitiveness. |

Appendix 11a

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| S.92 | In terms of company size, both groups have equally low inter-personal competitiveness (scales 1 and 2). However, companies with 1-10 employees have a higher percentage of respondents in scale 1 than its counterpart. |
| S.93 | In terms of profession, it is inconclusive which group perceives lower interpersonal competitiveness. |
| S.94 | Almost half (44%) of the respondents' companies have a policy to reduce the use of electricity, but only 26% of the companies follow the policy properly. The success rate of electricity policies across companies is 59%. |
| S.95 | Only a third (34%) of the respondents' companies has a policy to reduce the use of water, and only 23% of the companies follow the policy properly. The success rate of water policies across companies is 37%. |
| S.96 | Most (72%) of the respondents' companies have a policy to reduce the use of paper, but only 41% of the companies follow the policy properly. The success rate of paper policies across companies is 57%. |
| S.97 | Almost a third (29%) of the respondents' companies has a policy to reduce the use of cars, but only 19% of the companies follow the policy properly. The success rate of car policies across companies is 67%. |
| S.98 | Paper policy is the most common (72%) policy across respondents. However, it ranks third in percentage of success (57%). |
| S.99 | Designers are more likely (54%) than accountants (37%) to have an electricity policy. |
| S.100 | Companies with 11+ employees are more likely (56%) than companies with less employees (37%) to have an electricity policy. |
| S.101 | Designers are more likely (50%) than accountants (23%) to have a water policy. |
| S.102 | Companies with 1-10 employees are equally likely as companies with 11+ employees (35%) to have a water policy. |
| S.103 | Designers are more likely (74%) than accountants (70%) to have a paper policy. |
| S.104 | Companies with 11+ employees are more likely (79%) than companies with 1-10 employees (67%) to have a paper policy. |
| S.105 | Designers are more likely (43%) than accountants (18%) to have a car policy. |
| S.106 | Companies with 1-10 employees are more likely (30%) than companies with 11+ employees (28%) to have a car policy. |
| S.107 | Designers are more likely to have green policies (electricity, water, paper and car) than accountants. |

Technology (S.108 to S.141)

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| S.108 | All respondents (100%) have Internet connection. |
| S.109 | Over two thirds (71%) have broadband Internet connection. About a quarter (24%) have wireless connection and few (5%) have dial-up connection. |
| S.110 | Respondents with dial-up Internet connection have mixed levels of adoption, 3 out of 5 have a web page, 1 out 5 have wireless network, 3 out of 5 have only flat panel monitors, 4 out of 5 use email over fax. Similarly the perception of the respondents about the adopter type of the company varies from scale 1 (laggards) to scale 4 (early adopters). One company has 100-150 employees; the remaining 4 have 1-10 employees. |
| S.111 | Three quarters of the respondents' companies (75%) have a website. |
| S.112 | Designers are more likely (91%) than Accountants (63%) to have web presence. |
| S.113 | Companies with 11+ employees are more likely (95%) than companies with 1-10 employees (62%) to have web presence. |
| S.114 | The majority of respondents (55%) do not have a wireless network. |
| S.115 | Accountants are slightly more likely (47%) than designers (42%) to have a wireless network. |
| S.116 | Companies with 11+ employees are more likely (51%) than companies with 1-10 employees (41%) to have a wireless network. |
| S.117 | Most of the respondents (80%) mostly have flat panel monitors, and 66% of them have only flat panels monitors. |
| S.118 | Almost all (6 out of 7) of respondents that have only CRT monitors also have broadband connection, the majority (4 out of 7) do not have a website, or wireless network (5 out of 7). Most of the respondents of this group (5 out of 7) use only email to communicate. Their adopter type varies from laggards to early majority, and almost all (6 out of 7) are small companies (1-10 employees). |
| S.119 | Almost all of the respondents' companies (93%) rely more on e-mails than faxes to send and receive information, and 67% use only e-mails. |
| S.120 | None of the respondents' companies rely solely on faxes to receive and send information (Scale 4). |
| S.121 | The majority of the respondents' organisations (65%) rarely print non-spam mails, 27% of them never print e-mails. |
| S.122 | Designers (67%) tend to print less frequently non-spam emails than accountants (61%). |
| S.123 | Companies with 1-10 employees (68%) tend to print non-spam emails less frequently than companies with 11+ employees (58%). |
| S.124 | The majority of respondents (55%) scan hardcopy documents. |

Appendix 11a

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| S.125 | Accountants (57%) are more likely to scan documents than designers (51%). |
| S.126 | Most companies with 11+ employees (72%) scan documents. On the other hand, the majority (59%) of companies with 1-10 employees do not scan documents. |
| S.127 | Early adopter is the most represented (37%) adopter type, followed by early majority (31%), late majority (16%), innovators (12%) and laggards (4%). |
| S.128 | Designers' companies are composed by 2% laggards, 9% late majority, 35% early majority, 35% early adopter and 20% innovators. |
| S.129 | Accountants' companies are composed by 5% laggards, 23% late majority, 30% early majority, 37% early adopter and 5% innovators. |
| S.130 | Companies with 1-10 employees are composed by 7% laggards, 20% late majority, 40% early majority, 22% early adopter and 11% innovators. |
| S.131 | Companies with 11 or more employees are composed by 0% laggards, 11% late majority, 20% early majority, 58% early adopter and 11% innovators. |
| S.132 | Innovators are more likely than laggards to use more and newer technology. |
| S.133 | Innovators are more likely than laggards to have a website. |
| S.134 | Laggards are less likely to have a wireless network. |
| S.135 | Innovators are more likely than laggards to use email over fax to receive and send information. |
| S.136 | In general, the adoption of technology increases with the adopter tendency towards innovation. |
| S.137 | Organisations with faster adoption of technology do NOT have higher time flexibility. (H0time) |
| S.138 | Organisations with faster adoption of technology do NOT have higher place flexibility. (H0place) |
| S.139 | Organisations with faster adoption of technology do NOT consider face-to-face interaction less important. (H0face-to-face) |
| S.140 | Organisations with faster adoption of technology do NOT have less bureaucracy. (H0Bureaucracy) |
| S.141 | Organisations with higher type of adoption of technology do NOT have a lower dependency on paper. (H0Paper) |

Alternative Ways of Working (S.142 to S.173)

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| S.142 | Most of the respondents' companies (80%) have not implemented hot-desking. |
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| S.143 | Designers (28%) are more likely to have hot-desking than accountants (13%). |
| S.144 | Companies with 1-10 employees (25%) are more likely to have hot-desking than companies with 11+ employees (12%). |
| S.145 | Less than half the companies (46%) offer teleworking to their employees. From this percentage, 48% of respondents work from home at least 1 day a week. The remaining 52% prefer to go to the office. |
| S.146 | The majority of the companies (51%) do not offer teleworking to their employees. From this percentage, 23% of the respondents would like to have the option of working from home. The remaining 77% do not want this option. |
| S.147 | In the case of some respondents (3%), it is unknown if their workplace offers teleworking. However, they would not take this option regardless of it being offered. |
| S.148 | Most of the respondents (66%) would rather go to the office than telework. |
| S.149 | Most of the respondents (65%) that telework do so only 1 day a week. |
| S.150 | Designers (24%) are more likely than accountants (21%) to telework. Designers (15%) are also more likely than accountants (9%) to wanting to have the option of teleworking. |
| S.151 | Respondents working in companies with 1-10 employees (29%) are more likely than larger companies (14%) to work from home. |
| S.152 | The group in which teleworking is not offered and the respondent is not interested in teleworking (Code 4) concentrates the highest percentage of respondents across all groups, designers 37%, accountants 43%, companies with 1-10 employees 37% and larger companies 44%. |
| S.153 | Overall, respondents identified more disadvantages (246) than advantages (224). |
| S.154 | The most common advantage of teleworking selected across all respondents is 'less commuting time' (38%), followed by 'more time with family' (20%), then with equal percentage (16%) 'more free time' and 'increased productivity', finally 'freeing up of office space' (10%). |
| S.155 | The most common disadvantage of teleworking selected across all respondents is 'no boundaries between home and work' (30%), followed by 'isolation' (25%), then with equal percentage (17%) 'lack of motivation' and 'lack of a suitable environment', finally 'longer working hours' (11%). |
| S.156 | Respondents that telework (49%) were slightly more likely to chose an advantage for teleworking than non teleworkers (41%). On the other hand, non-teleworkers were considerably more likely to select a disadvantage for teleworking (53%) than teleworkers (28%). |
| S.157 | The percentage range of disadvantages identified by non-teleworkers is higher (up to 80%) than the one of teleworkers (up to 46%). |

Appendix 11a

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| S.158 | Almost equal percentage of respondents that telework (81%) and do not telework (80%) consider 'less commuting time' to be an advantage of teleworking. |
| S.159 | Most respondents that do not telework (80%) consider 'no boundaries between home and work' to be a disadvantage of teleworking. However, less than half of the respondents that telework (46%) considered that. |
| S.160 | The majority of respondents that telework (58%) consider 'more time with family' to be an advantage of teleworking. However, less than half of the respondents that do not telework (41%) consider that. |
| S.161 | Most respondents that do not telework (62%) consider 'isolation' to be a disadvantage of teleworking. However, less than half of the respondents that telework (46%) consider that. |
| S.162 | More respondents that do not telework (49%) consider 'lack of motivation' as a disadvantage of teleworking than teleworkers (12%). |
| S.163 | The majority of respondents that telework (54%) consider 'increased productivity' to be an advantage of teleworking. However, less than a third of respondents that telework (28%) consider that. |
| S.164 | More respondents that do not telework (46%) consider 'lack of suitable environment' as a disadvantage of teleworking than teleworkers (19%). |
| S.165 | Almost all (98%) respondents have a computer at home and Internet connection (91%), most (83%) have a printer and some (28%) have a fax. |
| S.166 | Most (91%) of respondents have Internet access at home, 79% have Broadband/wireless and 12% have Dial-up Internet access. |
| S.167 | The majority of respondents (66%) spend 1 hr or less in daily commuting to work (return). |
| S.168 | The respondent with the longest commuting time of the study spends 5 hours (return) each day commuting to work using public transport. Despite already having a computer and broadband at home, the respondent would not consider teleworking. She is in her 40', is the manager of a design company with 1-10 employees located in the city and spends 100% of her time at the office building relationships and socialising. |
| S.169 | The range '0: 46-1: 00' concentrates the highest percentage (22%) of respondents in a single range, closely followed by the '0: 16-0: 30' range (21%). The shortest travel time range of '01-0: 15' concentrates 11% of the respondents. |
| S.170 | The majority of respondents (67%) use cars as the main way of transportation to get to work. |
| S.171 | The percentage of respondents using public transport to get to work (18%) is slightly higher than the percentage travelling by foot or bicycle (15%). |
| S.172 | The percentage of respondents using cars to get to their workplace in the suburbs (76%) is higher than the percentage of respondents using cars to get to their workplace in the city (57%). |

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- S.173** The percentage of respondents using public transport to get to their workplace in the city (27%) is higher than the percentage of respondents using public transport to get to their workplace in the city (10%).
-

CASE STUDY A

Office environment (CS-A.1 to CS-A.12)

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- CS-A.1** IT can standardise the layout of offices across disciplines.
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- CS-A.2** The company has an Information age office model layout as described by Giuliano (1985).
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- CS-A.3** The office layout reflect the need of team collaboration.
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- CS-A.4** All employees work in the same type of modular workstation.
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- CS-A.5** The floor plan does not reflect hierarchy.
-
- CS-A.6** The office environment successfully satisfies spatial parameters (h to m) across all participants.
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- CS-A.7** The office environment fails to equally satisfy comfort and privacy parameters across participants. The most variable parameter is 'g) Voice privacy'.
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- CS-A.8** Flat panel monitors can reduce the foot print of technology on workstation.
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- CS-A.9** The different levels of tidiness of the workstation is a personal effect rather than a shortage of storage and the perception of the size of working space is unaffected by the increased amount of clutter.
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- CS-A.10** There are no apparent objective reasons for the temperature and ventilation discomfort experienced by participant CSA-4.
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- CS-A.11** The consistency by which participants assess temperature and ventilation comfort suggests a correlation between these two parameters.
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- CS-A.12** The distance from a natural source of light (window) is a plausible objective explanation for CSA-1 lower illumination satisfaction.
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Work habits (CS-A.13 to CS-A.20)

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- CS-A.13** Participants work an average of 40.8 h.p.w. The highest number of w.h.p. (45) is registered by CSA-5 (Director). The lowest (39) is registered by CSA-4 (Project Co-ordinator).
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- CS-A.14** Senior management participants (CSA-2, CSA-3 and CSA-5) have on average a higher workload than participants in other positions (CSA-1 and CSA-4).
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Appendix 11a

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| CS-A.15 | On average, participants spend 70% doing individual work and quiet thinking, 23% face-to-face collaboration and 7% building relationships and socialising. |
| CS-A.16 | On average participants spend 65% doing quiet solo work, 12% in face-to-face meetings, 7% talking over the telephone, 9% writing/reading e-mails and 7% outside the office. |
| CS-A.17 | The majority of participants spend more time communicating over e-mail than telephone. The highest difference is 2% Telephone, 8% e-mail. Only one participant spends the same percentage of time on both. |
| CS-A.18 | Participant CSA-1 spends on average almost all of his time (96%) doing quiet solo work (86%) and writing/reading emails (8%) and he completely disagrees that he could work from home or other place outside the office. |
| CS-A.19 | Participant CSA-5 spends on average 35% of his time doing quiet solo work, 26% in face to face-meetings, 9% over the telephone, 10% writing/reading emails and 20% outside the office and considers that he could possibly work four out of five days from home or somewhere outside the office. |
| CS-A.20 | Participant CSA-4 agrees that on one day, she could have worked from home or somewhere outside the office. During this day she spend 80% of her time doing quiet solo work, 10% in face-to-face meetings, 5% over the telephone and 5% on writing/reading emails. |

Organisation context (CS-A.21 to CS-A.26)

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| CS-A.21 | The majority of participants (3) consider the organisation to be inflexible (Scale 2) about the time when employees need to do their work. The remaining participants (2) consider the organisation flexible (Scale 3). |
| CS-A.22 | The majority of participants (3) consider the organisation to be inflexible (Scale 2) about the place where employees need to do their work. The remaining participants (2) consider the organisation flexible (Scale 3). |
| CS-A.23 | The perception of the bureaucracy level varies across participants, with two considering the organisation to be relaxed (Scale 1) in its procedures, other two participants relaxed (Scale 2) and the reminding participant strict (3). |
| CS-A.24 | The perception of interpersonal competitiveness varies across participants, three consider it to be low (Scale 1), one low (Scale 2) and one high (Scale 3). |
| CS-A.25 | The majority of participants (4) have a very high dependency (Scale 4) on a computer to do their daily work. The remaining participant has a high (Scale 3) dependency. |
| CS-A.26 | The majority of participants (3) spend most of their time (Scale 4) on their workstation. The remaining two, have a high dependency (Scale 3). |

Technology (CS-A.27 to CS-A.29)

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| CS-A.27 | All participants have a desktop computer and all monitors in the office are flat-panel. The office has broadband Internet connection and a webpage, but no wireless network. Participants use e-mail over fax to communicate. Scanning of documents as well as printing of e-mails varies across participants. |
| CS-A.28 | The perception of adopter type varies considerably across participants, going from “Innovators” to “Late Majority”. |
| CS-A.29 | Almost all (4 out of 5) participants have a computer at home. All the participants that have a computer at home have broadband Internet. The majority of participants (3 out of 4) that have a computer also have a printer. The only participant that has a fax is the same without a computer. |
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Alternative Ways of Working (CS-A.30 to CS-A.36)

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| CS-A.30 | Only one participant knows that hot-desking is implemented at their office. Floor plan analysis shows 4 workstations dedicated to this purpose. |
| CS-A.31 | All participants prefer each other’s workstations for work related interaction. |
| CS-A.32 | All case study participants (5) answered that teleworking is an option available at their office but they do not use it and they rather go to the office. |
| CS-A.33 | All participants commute to their workplace by car. The average commuting time is 44 minutes. The quickest trip (CSA-2) takes 20 minutes, the longest (CSA-5) 75 minutes. |
| CS-A.34 | All participants (5) identify “Less commuting time” as an advantage of working from home. “More time with family” was identified by the majority (3) of participants as an advantage of teleworking, whilst only one participant considered “freeing up of office space” to also be an advantage. |
| CS-A.35 | “Isolation”, “Lack of suitable environment” and “No boundaries between home/work” were identified by 3 participants (not the same ones) as disadvantages of working from home. One participant (not the same one) identified “Longer working hours” and “Lack of motivation” as disadvantages of working from home. |
| CS-A.36 | Overall, more disadvantages (11) were identified over advantages (9) of working from home. All options from disadvantages were selected at least once by one participant, whilst two options from advantages were unselected. |
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CASE STUDY B

Company A: Alternative Ways of Working (CS-B.1 to CS-B.10)

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| CS-B.1 | Hosting meetings in virtual worlds can reduce travelling costs and inconveniences whilst providing a better collaboration environment than video conferencing. |
| CS-B.2 | Virtual worlds are subject to real life expenses in terms of taxes and must adhere to company and commercial law. |
| CS-B.3 | Organisations from various industries across public and private sectors can benefit from virtual worlds. |
| CS-B.4 | It is currently necessary to download a free software (Second Life viewer) to run Company's A working environment. However, this requirement might not be necessary in future developments. |
| CS-B.5 | Virtual worlds can reduce real travel by eliminating geographic boundaries. |
| CS-B.6 | In-world communication can be done via keyboard inputs and speech. |
| CS-B.7 | Technology is instrumental to society. |
| CS-B.8 | Virtual worlds can provide a new work environment and culture which simplify communication and coordination of information. |
| CS-B.9 | Virtual worlds have the potential to redefine the way we work and could overtake videoconferencing and face-to-face meetings. |
| CS-B.10 | Virtual worlds have the potential to host the office of the future. |

Company B: Office environment (CS-B.11 to CS-B.17)

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| CS-B.11 | Office environments can be used to promote a creative and inspirational atmosphere. |
| CS-B.12 | Office space can be used to project an image of the company to its clients. |
| CS-B.13 | Open-plan layouts can promote a sense of freedom inside the office. |
| CS-B.14 | The new floor plan office keeps the division between creatives and account managers as well as the open plan layout of the old office. |
| CS-B.15 | Regardless of the profession (creatives/account managers) or position (senior management/other) employees work in the same type of workstation. |
| CS-B.16 | The floor plan does not reflect hierarchy. |

CS-B.17 Supposedly better designed spaces do not necessarily engender better levels of environmental satisfaction.

Company B: Work habits (CS-B.18 to CS-B.22)

CS-B.18 An activity can define a technology as much as a technology defines the activity.

CS-B.19 The organic nature of the design concept heavily relies on paper. There is currently no technology that can match the qualities of paper at the concept design stage.

CS-B.20 Creatives tend to spend more time doing quiet solo work than account managers.

CS-B.21 Account managers tend to spend more time writing/reading emails and over the phone than creatives.

CS-B.22 Face-to-face interaction is equally important (Scale 4 and 3) for creatives and account managers.

Company B: Technology (CS-B.23 to CS-B.27)

CS-B.23 The company has broadband Internet, a website, wireless network and mostly flat panel monitors.

CS-B.24 The company's website has a blog discussing marketing and technology topics.

CS-B.25 Both directors are technology observers and believe that through the use of technology they can offer a better service to their clients.

CS-B.26 Participants' perception of the company's type of technology adopter are distributed between 'early adopter' and 'early majority'. Three participants changed their perception following the relocation to the new office, two went from 'early adopter' to 'early majority' and one from 'early majority' to 'early adopter'.

CS-B.27 Technology allows to increase the freedom in terms of how space is divided inside an office and allow people to be more mobile. However, this advantage can be missed by following traditional design paradigms.

Company B: Alternative Ways of Working (CS-B.28 to CS-B.42)

CS-B.28 Breaking away from the desk and going to 'think' to a more inspirational environment can improve performance.

CS-B.29 The Creative Director feels that he has to be in the office more than he would like to, to manage staff and workflow.

CS-B.30 Second Life attracts different demographics than other virtual world communities.

Appendix 11a

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| CS-B.31 | Second Life residents are male and female, well-off, thirty-something, white collar professionals, with a high representation from the creative, media and software industries. In marketing terms, a classic 'early adopter' profile of influential consumers. |
| CS-B.32 | Marketing companies are interested in Second Life because of the people it attracts and see it as another opportunity to help their clients make money. |
| CS-B.33 | Technologies like social networks and virtual worlds have changed marketing. |
| CS-B.34 | "To provide a virtual meeting space for staff and clients" is one of the primary objectives for creating the company's Second Life office. Other primary objectives include "to generate publicity and change perceptions of the company". |
| CS-B.35 | The company's virtual office is a glass sphere suspended over the sea with presentation areas, a showroom and breakout area. |
| CS-B.36 | What the Managing Director likes the most about the Second Life office is that it is the opposite of a real world office, but still has real functionality including meeting space and presentation areas. |
| CS-B.37 | At the moment, the company is using Second Life office for marketing purposes only and has not been able to use it for work collaboration activities. |
| CS-B.38 | Virtual meetings are the first work collaboration activity that the company wants to implement with its Second Life office. |
| CS-B.39 | The incapability of transmitting body language is identified by the Creative Director as the issue preventing virtual meeting to replace face-to-face meetings. |
| CS-B.40 | Adoption of virtual worlds for work collaboration purposes could be accelerated with the introduction of new generations in the workplace. |
| CS-B.41 | The capability of avatars to transmit emotions could improve communication in virtual worlds. However, for this to be successful, the avatar must transmit the true emotions of the user without the latter having any control over them. |
| CS-B.42 | Virtual worlds cannot transmit all the information we use to establish a connection during face-to-face meetings. |

CASE STUDY C

Office environment (CS-C.1 to CS-C.2)

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| CS-C.1 | The lowest ranked parameters (scale 1) are 'a) temperature comfort', 'f) visual privacy' and 'g) voice privacy'. |
| CS-C.2 | The highest ranked parameter (scale 4) is 'd) noise comfort'. |

Work habits (CS-C.3 to CS-C.10)

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| CS-C.3 | Working part-time as well as teleworking can hinder career development. Neither is recommended for commencing a career. |
| CS-C.4 | Working part-time promotes the feeling of working harder than full-timers in order to compensate for possible reservations of supervisors. Teleworking is seen as a more controversial arrangement than working part-time and further exacerbates this feeling. |
| CS-C.5 | Being at the office promotes casual work related interaction with workmates. Since this interaction arises randomly and out of an impulse it might not be as effective, or necessary, as if carefully planned and addressed during a formal meeting. |
| CS-C.6 | The participant spends 45% of her time doing 'individual work', 45% on 'face-to-face collaboration' and 10% on 'building relationships and socialising'. |
| CS-C.7 | The participant spends 30% of her time doing 'quiet solo work', 28% on 'face-to-face meetings', 5% on 'telephone', 17% on 'e-mails' and 20% 'outside the office'. |
| CS-C.8 | The participant completely depends on ICT to work. |
| CS-C.9 | Work is a paid or unpaid activity done to satisfy a specific objective. Overall, work is something that needs to be done as opposed to something that someone wants to do. |
| CS-C.10 | The office provides a defined space to work without the distractions of other environments. It also promotes work related interaction by gathering people working towards a common objective. |

Organisation context (CS-C.11 to CS-C.13)

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| CS-C.11 | For workplace policies to be successful it is necessary, but not sufficient, to provide the technology required to implement them. Policies need to be promoted and monitored for them to be successful. |
| CS-C.12 | The participant's office has policies to reduce the use of water and paper, but they are not properly followed. |
| CS-C.13 | Wireless networks can reduce printing by allowing access to documents anywhere in the office. |

Technology (CS-C.14 to CS-C.16)

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| CS-C.14 | The participant considers her organisation to be laggards in terms of technology adoption. Nevertheless, her office has broadband internet connection, web presence, have only flat-panel monitors, rely on e-mails over fax to communicate and hardcopy documents are scanned, but there is no wireless network. |
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Appendix 11a

CS-C.15 Cultural factors from the organisation's clients, like preference of face-to-face interaction over online communication, have slowed down the organisation's rate of adoption of technology.

CS-C.16 Younger generations can speed-up the adoption of new technology.

Alternative Ways of Working (CS-C.17 to CS-C.46)

CS-C.17 Hot-desking can be a source of time loss due to the daily routine of finding an available desk as well as setting up and putting away personal items.

CS-C.18 Hot-desking can create the feeling of loss of personal space and can be a frustrating experience.

CS-C.19 Hot-desking can be perceived as a 'price to pay' for being a part-time worker.

CS-C.20 The respondent's main motivation to work from home was to reduce the amount of travelling (time spend 'sitting in the car'. The respondent's travelling routine produces an estimate of almost half a tone of carbon dioxide every month and takes up to 5 hours per day.

CS-C.21 Public transport is not a viable way for the respondent to commute to work.

CS-C.22 The respondent identified 'freeing-up of office space' as the most important benefit of teleworking for the organisation. On the other hand, 'less commuting time' and 'more time with family' were the most important benefits for her.

CS-C.23 Staff at the respondent organisation are regularly reminded about the cost of rent.

CS-C.24 The respondent identified 'lack of suitable environment' and 'no boundaries between home and work' to be the most important disadvantages of teleworking.

CS-C.25 Working from home requires discipline to maintain the boundaries between work and home.

CS-C.26 The respondent believes that working part-time can create a feeling of isolation, which stems from missing out on important information.

CS-C.27 From the participant's point of view, employee underperformance is the organisation's biggest concern posed by teleworking.

CS-C.28 According to the participant, there is the perception that if someone is working from home they are really not working hard. Culture is the biggest problem for implementing teleworking.

CS-C.29 Security of confidential information is a concern for implementing teleworking.

CS-C.30 Teleworking is a right that needs to be earned through satisfactory performance.

CS-C.31 Teleworkers are required to spend 2/5 of their time at the office.

| | |
|----------------|---|
| CS-C.32 | Duties that are considered to be suitable for teleworking are those which are able to be performed fairly autonomously, require limited client contact, do not involve intensive team work and are easily monitored and measured. |
| CS-C.33 | The home site is considered to be part of the office and as such it must comply with the same OHS regulations as the office site. |
| CS-C.34 | Getting a teleworking application approved can take over 6months. |
| CS-C.35 | The onerous requirements and bureaucratic process of the teleworking agreement reflect the reservations of a conservative organisation resistant to new ideas and change. |
| CS-C.36 | Teleworking is considered to reduce costs of maintaining the site office as well as reduce absence on leave. |
| CS-C.37 | Teleworking can help to avoid loss of corporate and historic knowledge by retaining employees that cannot go to the office site to work. |
| CS-C.38 | Teleworking can facilitate employees to provide/receive care, but not during nominated working hours. |
| CS-C.39 | The minimum duration of a teleworking agreement is 6 months. There is no maximum times specified for doing HBW, but the agreement is reviewed every 12 months. |
| CS-C.40 | The HBW agreement can be terminated when the employee receives an unsatisfactory performance and development assessment (PDA), does not satisfy security and OHS requirements or by common agreement. |
| CS-C.41 | Variable working hours (VWH) offers the opportunity to employees to select the days they want to work (in case of part-timers) or work outside the traditional working hours. However, it is a separate and independent application process from HBW. |
| CS-C.42 | The respondent's vision of the office of the future is a well designed and efficient office-like environment with the capability to work from home. However, it is more about making the current office work than a futuristic approach. |
| CS-C.43 | An ongoing problem for the respondent is that she and her staff need to change their processes to suit the technology provided by the IT department rather than the IT giving them solutions that reflect their processes. |
| CS-C.44 | The expectation of improved efficiency created by the introduction of new technology is a source of problems between senior management and staff doing the process when the technology delivered is not properly designed. |
| CS-C.45 | The office of the future will more likely have considerable less space as rent becomes more expensive. Comfort will be sacrificed at the expense of location. |
| CS-C.46 | Buildings and their locations are seen as asset which can be used to attract talent into the organisation. |

χ^2 Test reports

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Appendix 11b

Table 11b.1. Summary of χ^2 results

| | Result ID | Variables | Null hypothesis at $\alpha=0.05$ | Test of independence value |
|----------------------|-------------------|--|----------------------------------|----------------------------|
| Environment | S.16 | Q3:Office layout/Q2.a:Temperature | Accepted | 0.674 |
| | S.17 | Q1:Type of building/Q2.b: Ventilation | Accepted | 0.110 |
| | S.18 | Q1:Type of building/Q2.c: Illumination | Accepted | 0.263 |
| | S.19 | Q1: Type of building/Q2.e: Freq. Distractions | Accepted | 0.331 |
| | S.20 | Q3:Office layout/Q2.f:Visual Privacy | Rejected | 0.001 |
| | S.21 | Q3:Office layout/Q2.g:Voice Privacy | Rejected | 0.0002 |
| | S.22 | Q1:Type of building/ Q2.h Spatial arrangement | Rejected | 0.0273 |
| | S.23 | Q3:Office layout/Q2.h:Spatial arrangement | Accepted | 0.1861 |
| Work habits | S.33 | Q13:Hours Work p.w./Profession (A/B) | Accepted | 0.329 |
| | S.34a | Q13:Hours Work p.w./Profession (A/B) | Accepted | 0.754 |
| | S.34b/S.35 | Q13:Hours Work p.w./Position (SM/O) | Rejected | 0.0008 |
| | S.38a | Q14:Frequency taking work home/Profession (A/B) | Accepted | 0.8719 |
| | S.38b/S.39 | Q14:Frequency taking work home/Position (SM/O) | Accepted | 0.0923 |
| | S.41a | Q15:Freq. working on weekends/Profession (A/B) | Accepted | 0.8310 |
| | S.41b/S.42 | Q15:Freq. working on weekends/Position (SM/O) | Rejected | 0.0002 |
| | S.61a | Q5.1: Amount of solo/quiet work/Profession (A/B) | Accepted | 0.388 |
| | S.61b | Q5.1: Amount of solo/quiet work/Position (SM/O) | Accepted | 0.307 |
| | S.62a | Q5.2: Amount of collaboration work/Profession (A/B) | Accepted | 0.332 |
| | S.62b | Q5.2: Amount of collaboration work/Position (SM/O) | Accepted | 0.441 |
| | S.64a | Q5.3: Amount of socialising/Profession (A/B) | Accepted | 0.069 |
| | S.64b | Q5.3: Amount of socialising/Position (SM/O) | Accepted | 0.879 |
| Organisation context | S.80 | Q7: Time flexibility/Size (1-10/11+) | Rejected | 0.004 |
| | S.81 | Q7: Time flexibility/Profession (A/B) | Accepted | 0.302 |
| | S.84 | Q8: Place flexibility/Profession (A/B) | Accepted | 0.484 |
| | S.85 | Q8: Place flexibility/Size (1-10/11+) | Rejected | 0.023 |
| | S.89 | Q10: Bureaucracy/Size(1-10/11+) | Accepted | 0.057 |
| | S.90 | Q10: Bureaucracy/Profession(A/B) | Accepted | 1.000 |
| | S.92 | Q11: Competitiveness/Size (1-10/11+) | Accepted | 0.078 |
| | S.93 | Q11: Competitiveness/Profession (A/B) | Accepted | 0.595 |
| Technology | S.112 | Q19: Website/Profession (A/B) | Rejected | 0.001 |
| | S.113 | Q19: Website/Size (1-10/11+) | Rejected | 0.0001 |
| | S.115 | Q20: Wireless Network/Profession (A/B) | Accepted | 0.6040 |
| | S.116 | Q20: Wireless Network/Size (1-10/11+) | Accepted | 0.2933 |
| | S.122 | Q24: Printing frequency/Profession (A/B) | Accepted | 0.5289 |
| | S.123 | Q24: Printing frequency/Size (1-10/11+) | Accepted | 0.2876 |
| | S.125 | Q25: Scanning of documents/Profession (A/B) | Accepted | 0.5452 |
| | S.126 | Q25: Scanning of documents/Size(1-10/11+) | Rejected | 0.0022 |
| AWW | S.143 | Q27: Hotdesking/Profession (A/B) | Rejected | 0.0460 |
| | S.144 | Q27: Hotdesking/Size(1-10/11+) | Accepted | 0.0831 |
| | S.150 | Q29: Teleworking/Profession (A/B) | Accepted | 0.7095 |
| | S.151 | Q29: Teleworking/Size(1-10/11+) | Accepted | 0.0554 |

χ^2 Test report**Result:** S.16**Variables**Variable 1: **Office layout (Q3)**Variable 2: **Temperature (Q2.a)****Hypotheses**

H0: Office layout (Q3) and Temperature (Q2.a) are independent.

H1: Office layout (Q3) and Temperature (Q2.a) are NOT independent.

Actual values

| | | Enclosed | Open | Total |
|-------|---|----------|------|-------|
| Scale | 1 | 1 | 4 | 5 |
| | 2 | 8 | 14 | 22 |
| | 3 | 17 | 23 | 40 |
| | 4 | 14 | 16 | 30 |
| Total | | 40 | 57 | 97 |

Expected values

| | | Enclosed | Open | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 2.0618557 | 2.938144 | 5 |
| | 2 | 9.0721649 | 12.92784 | 22 |
| | 3 | 16.494845 | 23.50515 | 40 |
| | 4 | 12.371134 | 17.62887 | 30 |
| Total | | 40 | 57 | 97 |

Test statistic

| | | |
|--|----------|----------|
| 0.485000 | 5.445614 | 5.930614 |
| 7.0545455 | 15.16108 | 22.21563 |
| 17.520625 | 22.5057 | 40.02633 |
| 15.843333 | 14.52164 | 30.36497 |
| Test statistic= 98.53754 -97= 1.537542 | | |

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

1.53754153375863 > 7.815= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.674**

χ^2 Test report**Result:** S.17**Variables**Variable 1: **Type of building (Q1)**Variable 2: **Ventilation (Q2.b)****Hypotheses**

H0: Type of building (Q1) and Ventilation (Q2.b) are independent.

H1: Type of building (Q1) and Ventilation (Q2.b) are NOT independent.

Actual values

| | | Adapted | Purpose | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 0 | 6 | 6 |
| | 2 | 2 | 18 | 20 |
| | 3 | 13 | 26 | 39 |
| | 4 | 10 | 26 | 36 |
| Total | | 25 | 76 | 101 |

Expected values

| | | Adapted | Purpose | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 1.4851485 | 4.514851 | 6 |
| | 2 | 4.950495 | 15.0495 | 20 |
| | 3 | 9.6534653 | 29.34653 | 39 |
| | 4 | 8.9108911 | 27.08911 | 36 |
| Total | | 25 | 76 | 101 |

Test statistic

| | | |
|-----------|----------|-----------------|
| 0.000000 | 7.973684 | 7.973684 |
| 0.808 | 21.52895 | 22.33695 |
| 17.506667 | 23.03509 | 40.54175 |
| 11.222222 | 24.95468 | 36.1769 |

$$\text{Test statistic} = 107.0293 - 101 = 6.029287$$

$$\text{Degrees of Freedom (DF)} = (r-1) \times (c-1) = 3$$

$$\text{Critical Value of Chi-square at 0.05 and 3 DF} = 7.815$$

Testing the null hypothesis (H0)

Test statistic > Critical value

$$6.02928654970759 > 7.815 = \text{FALSE}$$

Therefore: H0 Accepted

$$\text{Test of independence value (MS Excel)} = 0.110$$

χ^2 Test report**Result:** S.18**Variables**Variable 1: **Type of building (Q1)**Variable 2: **Illumination (Q2.c)****Hypotheses**

H0: Type of building (Q1) and Illumination (Q2.c) are independent.

H1: Type of building (Q1) and Illumination (Q2.c) are NOT independent.

Actual values

| | | Adapted | Purpose | Total | |
|-------|---|---------|---------|-------|------------------|
| Scale | 1 | 0 | 0 | 0 | Row not included |
| | 2 | 7 | 11 | 18 | |
| | 3 | 8 | 34 | 42 | |
| | 4 | 10 | 31 | 41 | |
| Total | | 25 | 76 | 101 | |

Expected values

| | | Adapted | Purpose | Total | |
|-------|---|-----------|----------|-------|------------------|
| Scale | 1 | 0 | 0 | 0 | Row not included |
| | 2 | 4.4554455 | 13.54455 | 18 | |
| | 3 | 10.39604 | 31.60396 | 42 | |
| | 4 | 10.148515 | 30.85149 | 41 | |
| Total | | 25 | 76 | 101 | |

Test statistic

| | #DIV/0! | #DIV/0! | #DIV/0! | |
|---------------------------------------|-----------|----------|----------|------------------|
| | 10.997778 | 8.93348 | 19.93126 | Row not included |
| | 6.1561905 | 36.57769 | 42.73388 | |
| | 9.8536585 | 31.14923 | 41.00289 | |
| Test statistic= 103.668 -101= 2.66803 | | | | |

Degrees of Freedom (DF)= (r-1)x(c-1) = 2**Critical Value of Chi-square at 0.05 and 2 DF =** 5.991**Testing the null hypothesis (H0)**

Test statistic > Critical value

2.66803034007785 > 5.991= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.263

χ^2 Test report**Result:** S.19**Variables**Variable 1: **Type of building (Q1)**Variable 2: **Freq. of distractions (Q2.e)****Hypotheses**

H0: Type of building (Q1) and Freq. of distractions (Q2.e) are independent.

H1: Type of building (Q1) and Freq. of distractions (Q2.e) are NOT independent.

Actual values

| | | Adapted | Purpose | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 0 | 6 | 6 |
| | 2 | 7 | 23 | 30 |
| | 3 | 9 | 30 | 39 |
| | 4 | 9 | 17 | 26 |
| Total | | 25 | 76 | 101 |

Expected values

| | | Adapted | Purpose | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 1.4851485 | 4.514851 | 6 |
| | 2 | 7.4257426 | 22.57426 | 30 |
| | 3 | 9.6534653 | 29.34653 | 39 |
| | 4 | 6.4356436 | 19.56436 | 26 |
| Total | | 25 | 76 | 101 |

Test statistic

| | | |
|-----------|----------|-----------------|
| 0.000000 | 7.973684 | 7.973684 |
| 6.5986667 | 23.43377 | 30.03244 |
| 8.3907692 | 30.66802 | 39.05879 |
| 12.586154 | 14.77176 | 27.35791 |

$$\text{Test statistic} = 104.4228 - 101 = 3.422823$$

$$\text{Degrees of Freedom (DF)} = (r-1) \times (c-1) = 3$$

$$\text{Critical Value of Chi-square at 0.05 and 3 DF} = 7.815$$

Testing the null hypothesis (H0)

Test statistic > Critical value

$$3.42282321187585 > 7.815 = \text{FALSE}$$

Therefore: H0 Accepted

$$\text{Test of independence value (MS Excel)} = 0.331$$

χ^2 Test report**Result:** S.20**Variables**Variable 1: **Office layout (Q3)**Variable 2: **Visual privacy (Q2.f)****Hypotheses**

H0: Office layout (Q3) and Visual privacy (Q2.f) are independent.

H1: Office layout (Q3) and Visual privacy (Q2.f) are NOT independent.

Actual values

| | | Enclosed | Open | Total |
|-------|---|----------|------|-------|
| Scale | 1 | 2 | 18 | 20 |
| | 2 | 4 | 13 | 17 |
| | 3 | 15 | 11 | 26 |
| | 4 | 19 | 15 | 34 |
| Total | | 40 | 57 | 97 |

Expected values

| | | Enclosed | Open | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 8.2474227 | 11.75258 | 20 |
| | 2 | 7.0103093 | 9.989691 | 17 |
| | 3 | 10.721649 | 15.27835 | 26 |
| | 4 | 14.020619 | 19.97938 | 34 |
| Total | | 40 | 57 | 97 |

Test statistic

| | | |
|-----------|----------|----------|
| 0.485000 | 27.56842 | 28.05342 |
| 2.2823529 | 16.91744 | 19.19979 |
| 20.985577 | 7.919703 | 28.90528 |
| 25.747794 | 11.26161 | 37.0094 |

$$\text{Test statistic} = 113.1679 - 97 = 16.1679$$

$$\text{Degrees of Freedom (DF)} = (r-1) \times (c-1) = 3$$

$$\text{Critical Value of Chi-square at 0.05 and 3 DF} = 7.815$$

Testing the null hypothesis (H0)

Test statistic > Critical value

$$16.1678987060411 > 7.815 = \text{TRUE}$$

Therefore: H0 Rejected

$$\text{Test of independence value (MS Excel)} = 0.001$$

χ^2 Test report**Result:** S.21**Variables**Variable 1: **Office layout (Q3)**Variable 2: **Voice privacy (Q2.g)****Hypotheses**

H0: Office layout (Q3) and Voice privacy (Q2.g) are independent.

H1: Office layout (Q3) and Voice privacy (Q2.g) are NOT independent.

Actual values

| | | Enclosed | Open | Total |
|-------|---|----------|------|-------|
| Scale | 1 | 5 | 25 | 30 |
| | 2 | 7 | 17 | 24 |
| | 3 | 16 | 6 | 22 |
| | 4 | 12 | 9 | 21 |
| Total | | 40 | 57 | 97 |

Expected values

| | | Enclosed | Open | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 12.371134 | 17.62887 | 30 |
| | 2 | 9.8969072 | 14.10309 | 24 |
| | 3 | 9.0721649 | 12.92784 | 22 |
| | 4 | 8.6597938 | 12.34021 | 21 |
| Total | | 40 | 57 | 97 |

Test statistic

| | | |
|-----------|----------|----------|
| 2.020833 | 35.45322 | 37.47405 |
| 4.9510417 | 20.49196 | 25.443 |
| 28.218182 | 2.784689 | 31.00287 |
| 16.628571 | 6.56391 | 23.19248 |

$$\text{Test statistic} = 117.1124 - 97 = 20.1124$$

$$\text{Degrees of Freedom (DF)} = (r-1) \times (c-1) = 3$$

$$\text{Critical Value of Chi-square at 0.05 and 3 DF} = 7.815$$

Testing the null hypothesis (H0)

Test statistic > Critical value

$$20.1124024550011 > 7.815 = \text{TRUE}$$

Therefore: H0 Rejected

$$\text{Test of independence value (MS Excel)} = 0.0002$$

χ^2 Test report**Result:** S.22**Variables**Variable 1: **Type of building (Q1)**Variable 2: **Spatial arrangem't (Q2.h)****Hypotheses**

H0: Type of building (Q1) and Spatial arrangem't (Q2.h) are independent.

H1: Type of building (Q1) and Spatial arrangem't (Q2.h) are NOT independent.

Actual values

| | | Enclosed | Open | Total |
|-------|---|----------|------|-------|
| Scale | 1 | 1 | 0 | 1 |
| | 2 | 1 | 13 | 14 |
| | 3 | 7 | 34 | 41 |
| | 4 | 15 | 28 | 43 |
| Total | | 24 | 75 | 99 |

Expected values

| | | Enclosed | Open | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 0.2424242 | 0.757576 | 1 |
| | 2 | 3.3939394 | 10.60606 | 14 |
| | 3 | 9.9393939 | 31.06061 | 41 |
| | 4 | 10.424242 | 32.57576 | 43 |
| Total | | 24 | 75 | 99 |

Test statistic

| | | |
|-----------|----------|----------|
| 4.125000 | 0 | 4.125 |
| 0.2946429 | 15.93429 | 16.22893 |
| 4.929878 | 37.21756 | 42.14744 |
| 21.584302 | 24.06698 | 45.65128 |

Test statistic= 108.1526 -99= 9.152647

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

9.15264666558626 > 7.815= TRUE

Therefore: H0 Rejected

Test of independence value (MS Excel)= 0.0273

χ^2 Test report**Result:** S.23**Variables**Variable 1: **Office layout (Q3)**Variable 2: **Spatial arrangement (Q2.h)****Hypotheses**

H0: Office layout (Q3) and Spatial arrangement (Q2.h) are independent.

H1: Office layout (Q3) and Spatial arrangement (Q2.h) are NOT independent.

Actual values

| | | Enclosed | Open | Total |
|-------|---|----------|------|-------|
| Scale | 1 | 1 | 0 | 1 |
| | 2 | 3 | 12 | 15 |
| | 3 | 18 | 20 | 38 |
| | 4 | 17 | 24 | 41 |
| Total | | 39 | 56 | 95 |

Expected values

| | | Enclosed | Open | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 0.4105263 | 0.589474 | 1 |
| | 2 | 6.1578947 | 8.842105 | 15 |
| | 3 | 15.6 | 22.4 | 38 |
| | 4 | 16.831579 | 24.16842 | 41 |
| Total | | 39 | 56 | 95 |

Test statistic

| | | |
|-----------|----------|----------|
| 2.435897 | 0 | 2.435897 |
| 1.4615385 | 16.28571 | 17.74725 |
| 20.769231 | 17.85714 | 38.62637 |
| 17.170106 | 23.83275 | 41.00286 |

Test statistic= 99.81238 -95= 4.812383

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

4.81238273921201 > 7.815= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.1861**

χ^2 Test report**Result:** S.33**Variables**Variable 1: **Hours Work p.w (Q.13)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Hours Work p.w (Q.13) and Profession (A/B) are independent.

H1: Hours Work p.w (Q.13) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|------------|---------|---------|-------|
| Scale | 7.5 | 1 | 0 | 1 |
| | 7.6 to 15 | 1 | 0 | 1 |
| | 21 to 37.4 | 4 | 5 | 9 |
| | 37.5 | 0 | 4 | 4 |
| | 37.6 to 40 | 14 | 20 | 34 |
| | 41 to 45 | 2 | 4 | 6 |
| | 46 to 50 | 13 | 15 | 28 |
| | 51 to 55 | 2 | 1 | 3 |
| | 55 to 60 | 8 | 3 | 11 |
| | 61 to 65 | 0 | 1 | 1 |
| | 66 to 70 | 1 | 1 | 2 |
| | 71 to 75 | 0 | 2 | 2 |
| | 76 to 80 | 0 | 1 | 1 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|------------|-----------|----------|-------|
| Scale | 7.5 | 0.4466019 | 0.553398 | 1 |
| | 7.6 to 15 | 0.4466019 | 0.553398 | 1 |
| | 21 to 37.4 | 4.0194175 | 4.980583 | 9 |
| | 37.5 | 1.7864078 | 2.213592 | 4 |
| | 37.6 to 40 | 15.184466 | 18.81553 | 34 |
| | 41 to 45 | 2.6796117 | 3.320388 | 6 |
| | 46 to 50 | 12.504854 | 15.49515 | 28 |
| | 51 to 55 | 1.3398058 | 1.660194 | 3 |
| | 55 to 60 | 4.9126214 | 6.087379 | 11 |
| | 61 to 65 | 0.4466019 | 0.553398 | 1 |
| | 66 to 70 | 0.8932039 | 1.106796 | 2 |
| | 71 to 75 | 0.8932039 | 1.106796 | 2 |
| | 76 to 80 | 0.4466019 | 0.553398 | 1 |
| Total | | 46 | 57 | 103 |

Appendix 11b

Test statistic

| | | |
|-----------|----------|-----------------|
| 2.239130 | 0 | 2.23913 |
| 2.239130 | 0 | 2.23913 |
| 3.980676 | 5.019493 | 9.00017 |
| 0.000000 | 7.22807 | 7.22807 |
| 12.907928 | 21.25903 | 34.16696 |
| 1.492754 | 4.818713 | 6.311467 |
| 13.514752 | 14.52068 | 28.03543 |
| 2.985507 | 0.602339 | 3.587846 |
| 13.027668 | 1.478469 | 14.50614 |
| 0.000000 | 1.807018 | 1.807018 |
| 1.119565 | 0.903509 | 2.023074 |
| 0.000000 | 3.614035 | 3.614035 |
| 0.000000 | 1.807018 | 1.807018 |

Test statistic= 116.5655 -103= 13.56548

Degrees of Freedom (DF)= (r-1)x(c-1) = 12

Critical Value of Chi-square at 0.05 and 12 DF = 21.026

Testing the null hypothesis (H0)

Test statistic > Critical value

13.565481661541 > 21.026= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.329

χ^2 Test report**Result:** S.34a**Variables**Variable 1: **Hours Work p.w (Q.13)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Hours Work p.w (Q.13) and Profession (A/B) are independent.

H1: Hours Work p.w (Q.13) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|------------|---------|---------|-------|
| Scale | < 37.6 | 6 | 9 | 15 |
| | 37.6 to 40 | 14 | 20 | 34 |
| | >40 | 26 | 28 | 54 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|------------|-----------|----------|-------|
| Scale | < 37.6 | 6.6990291 | 8.300971 | 15 |
| | 37.6 to 40 | 15.184466 | 18.81553 | 34 |
| | >40 | 24.116505 | 29.8835 | 54 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|-----------------|----------|------------------------|
| 5.373913 | 9.757895 | 15.13181 |
| 12.907928 | 21.25903 | 34.16696 |
| 28.030596 | 26.23522 | 54.26581 |
| Test statistic= | | 103.5646 -103= 0.56458 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 2**Critical Value of Chi-square at 0.05 and 2 DF = 5.991****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.564579583846424 > 5.991= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.754**

χ^2 Test report**Result:** S.34b/S.35**Variables**Variable 1: **Hours Work p.w (Q.13)**Variable 2: **Position (SM/O)****Hypotheses**

H0: Hours Work p.w (Q.13) and Position (SM/O) are independent.

H1: Hours Work p.w (Q.13) and Position (SM/O) are NOT independent.

Actual values

| | | SM | O | Total |
|-------|------------|----|----|-------|
| Scale | < 37.6 | 9 | 6 | 15 |
| | 37.6 to 40 | 23 | 11 | 34 |
| | >40 | 51 | 3 | 54 |
| Total | | 83 | 20 | 103 |

Expected values

| | | SM | O | Total |
|-------|------------|-----------|----------|-------|
| Scale | < 37.6 | 12.087379 | 2.912621 | 15 |
| | 37.6 to 40 | 27.398058 | 6.601942 | 34 |
| | >40 | 43.514563 | 10.48544 | 54 |
| Total | | 83 | 20 | 103 |

Test statistic

| | | |
|-----------|----------|----------|
| 6.701205 | 12.36 | 19.0612 |
| 19.307938 | 18.32794 | 37.63588 |
| 59.773092 | 0.858333 | 60.63143 |

Test statistic= 117.3285 -103= 14.32851

Degrees of Freedom (DF)= (r-1)x(c-1) = 2**Critical Value of Chi-square at 0.05 and 2 DF = 5.991****Testing the null hypothesis (H0)**

Test statistic > Critical value

14.3285093314434 > 5.991= TRUE

Therefore: H0 Rejected

Test of independence value (MS Excel)= 0.0008

χ^2 Test report**Result:** S.38a**Variables**Variable 1: **Frequency taking work home (Q14)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Frequency taking work home (Q14) and Profession (A/B) are independent.

H1: Frequency taking work home (Q14) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 9 | 15 | 24 |
| | 2 | 18 | 24 | 42 |
| | 3 | 11 | 12 | 23 |
| | 4 | 5 | 5 | 10 |
| Total | | 43 | 56 | 99 |

Expected values

| | | Group A | Group B | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 10.424242 | 13.57576 | 24 |
| | 2 | 18.242424 | 23.75758 | 42 |
| | 3 | 9.989899 | 13.0101 | 23 |
| | 4 | 4.343434 | 5.656566 | 10 |
| Total | | 43 | 56 | 99 |

Test statistic

| | | |
|-----------|----------|----------|
| 7.770349 | 16.57366 | 24.34401 |
| 17.760797 | 24.2449 | 42.0057 |
| 12.112235 | 11.06832 | 23.18056 |
| 5.755814 | 4.419643 | 10.17546 |

Test statistic= 99.70572 -99= 0.705719

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.705719225253304 > 7.815=

FALSE**Therefore: H0 Accepted****Test of independence value (MS Excel)= 0.8719**

χ^2 Test report**Result:** S.38b/S.39**Variables**Variable 1: **Frequency taking work home (Q14)**Variable 2: **Position (SM/O)****Hypotheses**

H0: Frequency taking work home (Q14) and Position (SM/O) are independent.

H1: Frequency taking work home (Q14) and Position (SM/O) are NOT independent.

Actual values

| | | SM | O | Total |
|-------|---|----|----|-------|
| Scale | 1 | 19 | 5 | 24 |
| | 2 | 30 | 12 | 42 |
| | 3 | 21 | 2 | 23 |
| | 4 | 10 | 0 | 10 |
| Total | | 80 | 19 | 99 |

Expected values

| | | SM | O | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 19.393939 | 4.606061 | 24 |
| | 2 | 33.939394 | 8.060606 | 42 |
| | 3 | 18.585859 | 4.414141 | 23 |
| | 4 | 8.080808 | 1.919192 | 10 |
| Total | | 80 | 19 | 99 |

Test statistic

| | | |
|-----------|----------|----------|
| 18.614063 | 5.427632 | 24.04169 |
| 26.517857 | 17.86466 | 44.38252 |
| 23.727717 | 0.906178 | 24.6339 |
| 12.375000 | 0 | 12.375 |

Test statistic= 105.4331 -99= 6.433109

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

6.43310875694672 > 7.815= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.0923**

χ^2 Test report**Result:** S.41a**Variables**Variable 1: **Freq. working on weekends (Q15)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Freq. working on weekends (Q15) and Profession (A/B) are independent.

H1: Freq. working on weekends (Q15) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 11 | 16 | 27 |
| | 2 | 24 | 25 | 49 |
| | 3 | 9 | 12 | 21 |
| | 4 | 2 | 4 | 6 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 12.058252 | 14.94175 | 27 |
| | 2 | 21.883495 | 27.1165 | 49 |
| | 3 | 9.3786408 | 11.62136 | 21 |
| | 4 | 2.6796117 | 3.320388 | 6 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|-----------|----------|----------|
| 10.034622 | 17.1332 | 27.16782 |
| 26.321207 | 23.04869 | 49.3699 |
| 8.636646 | 12.39098 | 21.02762 |
| 1.492754 | 4.818713 | 6.311467 |

Test statistic= 103.8768 -103= 0.876815

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.876815341782105 > 7.815= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.8310

χ^2 Test report**Result:** S.41b/S.42**Variables**

Variable 1: Freq. working on weekends (Q15)

Variable 2: Position (SM/O)

Hypotheses

H0: Freq. working on weekends (Q15) and Position (SM/O) are independent.

H1: Freq. working on weekends (Q15) and Position (SM/O) are NOT independent.

Actual values

| | | SM | O | Total |
|-------|---|----|----|-------|
| Scale | 1 | 14 | 13 | 27 |
| | 2 | 43 | 6 | 49 |
| | 3 | 20 | 1 | 21 |
| | 4 | 6 | 0 | 6 |
| Total | | 83 | 20 | 103 |

Expected values

| | | SM | O | Total |
|-------|---|-----------|----------|-------|
| Scale | 1 | 21.757282 | 5.242718 | 27 |
| | 2 | 39.485437 | 9.514563 | 49 |
| | 3 | 16.92233 | 4.07767 | 21 |
| | 4 | 4.8349515 | 1.165049 | 6 |
| Total | | 83 | 20 | 103 |

Test statistic

| | | |
|-----------|----------|----------|
| 9.008478 | 32.23519 | 41.24366 |
| 46.827391 | 3.783673 | 50.61106 |
| 23.637407 | 0.245238 | 23.88264 |
| 7.445783 | 0 | 7.445783 |

Test statistic= 123.1832 -103= 20.18316

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

20.1831562075968 > 7.815= TRUE

Therefore: H0 Rejected

Test of independence value (MS Excel)= 0.0002

χ^2 Test report**Result:** S.61a**Variables**

Variable 1: Amount of solo/quiet work (Q5.1)

Variable 2: Profession (A/B)

Hypotheses

H0: Amount of solo/quiet work (Q5.1) and Profession (A/B) are independent.

H1: Amount of solo/quiet work (Q5.1) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|--------|---------|---------|-------|
| Scale | 90-100 | 4 | 6 | 10 |
| | 80-89 | 13 | 11 | 24 |
| | 70-79 | 8 | 7 | 15 |
| | 60-69 | 7 | 11 | 18 |
| | 50-59 | 3 | 8 | 11 |
| | 40-49 | 3 | 0 | 3 |
| | 30-39 | 4 | 7 | 11 |
| | 20-29 | 2 | 6 | 8 |
| | 10-19 | 1 | 1 | 2 |
| | 0 | 1 | 0 | 1 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|--------|-----------|----------|-------|
| Scale | 90-100 | 4.4660194 | 5.533981 | 10 |
| | 80-89 | 10.718447 | 13.28155 | 24 |
| | 70-79 | 6.6990291 | 8.300971 | 15 |
| | 60-69 | 8.038835 | 9.961165 | 18 |
| | 50-59 | 4.9126214 | 6.087379 | 11 |
| | 40-49 | 1.3398058 | 1.660194 | 3 |
| | 30-39 | 4.9126214 | 6.087379 | 11 |
| | 20-29 | 3.5728155 | 4.427184 | 8 |
| | 10-19 | 0.8932039 | 1.106796 | 2 |
| | 0 | 0.4466019 | 0.553398 | 1 |
| Total | | 46 | 57 | 103 |

Appendix 11b

Test statistic

| | | |
|-----------|----------|-----------------|
| 3.582609 | 6.505263 | 10.08787 |
| 15.767210 | 9.11038 | 24.87759 |
| 9.553623 | 5.902924 | 15.45655 |
| 6.095411 | 12.14717 | 18.24258 |
| 1.832016 | 10.51356 | 12.34557 |
| 6.717391 | 0 | 6.717391 |
| 3.256917 | 8.049442 | 11.30636 |
| 1.119565 | 8.131579 | 9.251144 |
| 1.119565 | 0.903509 | 2.023074 |
| 2.239130 | 0 | 2.23913 |

Test statistic= **112.5473** -103= **9.547265**

Degrees of Freedom (DF)= $(r-1) \times (c-1) =$ **9**

Critical Value of Chi-square at 0.05 and 9 DF = **16.919**

Testing the null hypothesis (H0)

Test statistic > Critical value

9.54726450238466 > 16.919= **FALSE**

Therefore: H0 Accepted

Test of independence value (MS Excel)= **0.388**

χ^2 Test report**Result:** S.61b**Variables**

Variable 1: Amount of solo/quiet work (Q5.1)

Variable 2: Position (SM/O)

Hypotheses

H0: Amount of solo/quiet work (Q5.1) and Position (SM/O) are independent.

H1: Amount of solo/quiet work (Q5.1) and Position (SM/O) are NOT independent.

Actual values

| | | SM | O | Total |
|-------|--------|----|----|-------|
| Scale | 90-100 | 7 | 3 | 10 |
| | 80-89 | 22 | 2 | 24 |
| | 70-79 | 10 | 5 | 15 |
| | 60-69 | 14 | 4 | 18 |
| | 50-59 | 7 | 4 | 11 |
| | 40-49 | 2 | 1 | 3 |
| | 30-39 | 11 | 0 | 11 |
| | 20-29 | 7 | 1 | 8 |
| | 10-19 | 2 | 0 | 2 |
| | 0 | 1 | 0 | 1 |
| Total | | 83 | 20 | 103 |

Expected values

| | | SM | O | Total |
|-------|--------|-----------|----------|-------|
| Scale | 90-100 | 8.0582524 | 1.941748 | 10 |
| | 80-89 | 19.339806 | 4.660194 | 24 |
| | 70-79 | 12.087379 | 2.912621 | 15 |
| | 60-69 | 14.504854 | 3.495146 | 18 |
| | 50-59 | 8.8640777 | 2.135922 | 11 |
| | 40-49 | 2.4174757 | 0.582524 | 3 |
| | 30-39 | 8.8640777 | 2.135922 | 11 |
| | 20-29 | 6.4466019 | 1.553398 | 8 |
| | 10-19 | 1.6116505 | 0.38835 | 2 |
| | 0 | 0.8058252 | 0.194175 | 1 |
| Total | | 83 | 20 | 103 |

Test statistic

| | | |
|-----------|----------|-----------------|
| 6.080723 | 4.635 | 10.71572 |
| 25.026104 | 0.858333 | 25.88444 |
| 8.273092 | 8.583333 | 16.85643 |
| 13.512718 | 4.577778 | 18.0905 |
| 5.527930 | 7.490909 | 13.01884 |
| 1.654618 | 1.716667 | 3.371285 |
| 13.650602 | 0 | 13.6506 |
| 7.600904 | 0.64375 | 8.244654 |
| 2.481928 | 0 | 2.481928 |
| 1.240964 | 0 | 1.240964 |

Test statistic= 113.5554 -103= 10.55535

Degrees of Freedom (DF)= (r-1)x(c-1) = 9

Critical Value of Chi-square at 0.05 and 9 DF = 16.919

Testing the null hypothesis (H0)

Test statistic > Critical value

10.555353832299 > 16.919= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.307

χ^2 Test report**Result:** S.62a**Variables**

Variable 1: Amount of collaboration work (Q5.2)

Variable 2: Profession (A/B)

Hypotheses

H0: Amount of collaboration work (Q5.2) and Profession (A/B) are independent.

H1: Amount of collaboration work (Q5.2) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|-------|---------|---------|-------|
| Scale | 60-69 | 1 | 2 | 3 |
| | 50-59 | 2 | 5 | 7 |
| | 40-49 | 1 | 9 | 10 |
| | 30-39 | 7 | 9 | 16 |
| | 20-29 | 13 | 15 | 28 |
| | 10-19 | 17 | 13 | 30 |
| | 1-9 | 4 | 3 | 7 |
| | 0 | 1 | 1 | 2 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|-------|-----------|----------|-------|
| Scale | 60-69 | 1.3398058 | 1.660194 | 3 |
| | 50-59 | 3.1262136 | 3.873786 | 7 |
| | 40-49 | 4.4660194 | 5.533981 | 10 |
| | 30-39 | 7.1456311 | 8.854369 | 16 |
| | 20-29 | 12.504854 | 15.49515 | 28 |
| | 10-19 | 13.398058 | 16.60194 | 30 |
| | 1-9 | 3.1262136 | 3.873786 | 7 |
| | 0 | 0.8932039 | 1.106796 | 2 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|-----------|----------|-----------------|
| 0.746377 | 2.409357 | 3.155734 |
| 1.279503 | 6.453634 | 7.733137 |
| 0.223913 | 14.63684 | 14.86076 |
| 6.857337 | 9.148026 | 16.00536 |
| 13.514752 | 14.52068 | 28.03543 |
| 21.570290 | 10.17953 | 31.74982 |
| 5.118012 | 2.323308 | 7.441321 |
| 1.119565 | 0.903509 | 2.023074 |

Test statistic= 111.0046 -103= 8.004634

Degrees of Freedom (DF)= (r-1)x(c-1) = 7

Critical Value of Chi-square at 0.05 and 7 DF = 14.067

Testing the null hypothesis (H0)

Test statistic > Critical value

8.00463409429372 > 14.067= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.332

χ^2 Test report**Result:** S.62b**Variables**

Variable 1: Amount of collaboration work (Q5.2)

Variable 2: Position (SM/O)

Hypotheses

H0: Amount of collaboration work (Q5.2) and Position (SM/O) are independent.

H1: Amount of collaboration work (Q5.2) and Position (SM/O) are NOT independent.

Actual values

| | | SM | O | Total |
|-------|-------|----|----|-------|
| Scale | 60-69 | 3 | 0 | 3 |
| | 50-59 | 7 | 0 | 7 |
| | 40-49 | 7 | 3 | 10 |
| | 30-39 | 11 | 5 | 16 |
| | 20-29 | 23 | 5 | 28 |
| | 10-19 | 26 | 4 | 30 |
| | 1-9 | 5 | 2 | 7 |
| | 0 | 1 | 1 | 2 |
| Total | | 83 | 20 | 103 |

Expected values

| | | SM | O | Total |
|-------|-------|-----------|----------|-------|
| Scale | 60-69 | 2.4174757 | 0.582524 | 3 |
| | 50-59 | 5.6407767 | 1.359223 | 7 |
| | 40-49 | 8.0582524 | 1.941748 | 10 |
| | 30-39 | 12.893204 | 3.106796 | 16 |
| | 20-29 | 22.563107 | 5.436893 | 28 |
| | 10-19 | 24.174757 | 5.825243 | 30 |
| | 1-9 | 5.6407767 | 1.359223 | 7 |
| | 0 | 1.6116505 | 0.38835 | 2 |
| Total | | 83 | 20 | 103 |

Appendix 11b

Test statistic

| | | |
|-----------|----------|-----------------|
| 3.722892 | 0 | 3.722892 |
| 8.686747 | 0 | 8.686747 |
| 6.080723 | 4.635 | 10.71572 |
| 9.384789 | 8.046875 | 17.43166 |
| 23.445353 | 4.598214 | 28.04357 |
| 27.963052 | 2.746667 | 30.70972 |
| 4.432014 | 2.942857 | 7.374871 |
| 0.620482 | 2.575 | 3.195482 |

Test statistic= 109.8807 -103= 6.880664

Degrees of Freedom (DF)= (r-1)x(c-1) = 7

Critical Value of Chi-square at 0.05 and 7 DF = 14.067

Testing the null hypothesis (H0)

Test statistic > Critical value

6.88066444348824 > 14.067= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.441

χ^2 Test report**Result:** S.64a**Variables**Variable 1: **Amount of socialising (Q5.3)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Amount of socialising (Q5.3) and Profession (A/B) are independent.

H1: Amount of socialising (Q5.3) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|--------|---------|---------|-------|
| Scale | 90-100 | 1 | 0 | 1 |
| | 60-69 | 3 | 0 | 3 |
| | 50-59 | 2 | 0 | 2 |
| | 40-49 | 0 | 5 | 5 |
| | 30-39 | 1 | 5 | 6 |
| | 20-29 | 10 | 10 | 20 |
| | 10-19 | 12 | 16 | 28 |
| | 1-9 | 15 | 16 | 31 |
| | 0 | 2 | 5 | 7 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|--------|-----------|----------|-------|
| Scale | 90-100 | 0.4466019 | 0.553398 | 1 |
| | 60-69 | 1.3398058 | 1.660194 | 3 |
| | 50-59 | 0.8932039 | 1.106796 | 2 |
| | 40-49 | 2.2330097 | 2.76699 | 5 |
| | 30-39 | 2.6796117 | 3.320388 | 6 |
| | 20-29 | 8.9320388 | 11.06796 | 20 |
| | 10-19 | 12.504854 | 15.49515 | 28 |
| | 1-9 | 13.84466 | 17.15534 | 31 |
| | 0 | 3.1262136 | 3.873786 | 7 |
| Total | | 46 | 57 | 103 |

Appendix 11b

Test statistic

| | | |
|-----------|----------|-----------------|
| 2.239130 | 0 | 2.23913 |
| 6.717391 | 0 | 6.717391 |
| 4.478261 | 0 | 4.478261 |
| 0.000000 | 9.035088 | 9.035088 |
| 0.373188 | 7.52924 | 7.902428 |
| 11.195652 | 9.035088 | 20.23074 |
| 11.515528 | 16.5213 | 28.03683 |
| 16.251753 | 14.92247 | 31.17422 |
| 1.279503 | 6.453634 | 7.733137 |

Test statistic= 117.5472 -103= **14.54723**

Degrees of Freedom (DF)= (r-1)x(c-1) = **8**

Critical Value of Chi-square at 0.05 and 8 DF = **15.507**

Testing the null hypothesis (H0)

Test statistic > Critical value

14.5472274069934 > 15.507=

FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= **0.069**

χ^2 Test report**Result:** S.64b**Variables**

Variable 1: Amount of socialising (Q5.3)

Variable 2: Position (SM/O)

Hypotheses

H0: Amount of socialising (Q5.3) and Position (SM/O) are independent.

H1: Amount of socialising (Q5.3) and Position (SM/O) are NOT independent.

Actual values

| | | SM | O | Total |
|-------|--------|----|----|-------|
| Scale | 90-100 | 1 | 0 | 1 |
| | 60-69 | 3 | 0 | 3 |
| | 50-59 | 2 | 0 | 2 |
| | 40-49 | 4 | 1 | 5 |
| | 30-39 | 5 | 1 | 6 |
| | 20-29 | 14 | 6 | 20 |
| | 10-19 | 24 | 4 | 28 |
| | 1-9 | 25 | 6 | 31 |
| | 0 | 5 | 2 | 7 |
| Total | | 83 | 20 | 103 |

Expected values

| | | SM | O | Total |
|-------|--------|-----------|----------|-------|
| Scale | 90-100 | 0.8058252 | 0.194175 | 1 |
| | 60-69 | 2.4174757 | 0.582524 | 3 |
| | 50-59 | 1.6116505 | 0.38835 | 2 |
| | 40-49 | 4.0291262 | 0.970874 | 5 |
| | 30-39 | 4.8349515 | 1.165049 | 6 |
| | 20-29 | 16.116505 | 3.883495 | 20 |
| | 10-19 | 22.563107 | 5.436893 | 28 |
| | 1-9 | 24.980583 | 6.019417 | 31 |
| | 0 | 5.6407767 | 1.359223 | 7 |
| Total | | 83 | 20 | 103 |

Appendix 11b

Test statistic

| | | |
|-----------|----------|-----------------|
| 1.240964 | 0 | 1.240964 |
| 3.722892 | 0 | 3.722892 |
| 2.481928 | 0 | 2.481928 |
| 3.971084 | 1.03 | 5.001084 |
| 5.170683 | 0.858333 | 6.029016 |
| 12.161446 | 9.27 | 21.43145 |
| 25.528399 | 2.942857 | 28.47126 |
| 25.019433 | 5.980645 | 31.00008 |
| 4.432014 | 2.942857 | 7.374871 |

Test statistic= 106.7535 -103= 3.753534

Degrees of Freedom (DF)= (r-1)x(c-1) = 8

Critical Value of Chi-square at 0.05 and 8 DF = 15.507

Testing the null hypothesis (H0)

Test statistic > Critical value

3.75353441415433 > 15.507= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.879

χ^2 Test report**Result:** S.80**Variables**

Variable 1: Time flexibility (Q7)

Variable 2: Size (1-10/11+)

Hypotheses

H0: Time flexibility (Q7) and Size (1-10/11+) are independent.

H1: Time flexibility (Q7) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Scale | 1 | 14 | 8 | 22 |
| | 2 | 9 | 16 | 25 |
| | 3 | 20 | 17 | 37 |
| | 4 | 17 | 2 | 19 |
| Total | | 60 | 43 | 103 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 12.81553 | 9.184466 | 22 |
| | 2 | 14.56311 | 10.43689 | 25 |
| | 3 | 21.5534 | 15.4466 | 37 |
| | 4 | 11.06796 | 7.932039 | 19 |
| Total | | 60 | 43 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 15.29394 | 6.968288 | 22.26223 |
| 5.562 | 24.52837 | 30.09037 |
| 18.55856 | 18.70962 | 37.26818 |
| 26.1114 | 0.504284 | 26.61569 |

Test statistic= 116.2365 - 103 = 13.23646

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

13.236461639786 > 7.815=

TRUE

Therefore: H0 Rejected

Test of independence value (MS Excel)= 0.004

χ^2 Test report**Result:** S.81**Variables**

Variable 1: Time flexibility (Q7)

Variable 2: Profession (A/B)

Hypotheses

H0: Time flexibility (Q7) and Profession (A/B) are independent.

H1: Time flexibility (Q7) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 10 | 12 | 22 |
| | 2 | 9 | 16 | 25 |
| | 3 | 15 | 22 | 37 |
| | 4 | 12 | 7 | 19 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 9.825243 | 12.17476 | 22 |
| | 2 | 11.16505 | 13.83495 | 25 |
| | 3 | 16.52427 | 20.47573 | 37 |
| | 4 | 8.485437 | 10.51456 | 19 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 10.17787 | 11.82775 | 22.00562 |
| 7.254783 | 18.50386 | 25.75864 |
| 13.61633 | 23.63774 | 37.25408 |
| 16.97025 | 4.660203 | 21.63045 |

Test statistic= 106.6488 - 103 = 3.648791

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

3.64879065350702 > 7.815 = FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.302

χ^2 Test report**Result:** S.84**Variables**Variable 1: **Place flexibility (Q8)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Place flexibility (Q8) and Profession (A/B) are independent.

H1: Place flexibility (Q8) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 20 | 18 | 38 |
| | 2 | 17 | 21 | 38 |
| | 3 | 6 | 11 | 17 |
| | 4 | 3 | 7 | 10 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 16.97087 | 21.02913 | 38 |
| | 2 | 16.97087 | 21.02913 | 38 |
| | 3 | 7.592233 | 9.407767 | 17 |
| | 4 | 4.466019 | 5.533981 | 10 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 23.56979 | 15.4072 | 38.977 |
| 17.02918 | 20.97091 | 38.00009 |
| 4.741688 | 12.86171 | 17.6034 |
| 2.015217 | 8.854386 | 10.8696 |

Test statistic= $105.4501 - 103 = 2.450091$ **Degrees of Freedom (DF)= (r-1)x(c-1) = 3****Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

 $2.45009103725796 > 7.815 = \text{FALSE}$

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.484

χ^2 Test report**Result:** S.85**Variables**Variable 1: **Place flexibility (Q8)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Place flexibility (Q8) and Size (1-10/11+) are independent.

H1: Place flexibility (Q8) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Scale | 1 | 26 | 12 | 38 |
| | 2 | 17 | 21 | 38 |
| | 3 | 8 | 9 | 17 |
| | 4 | 9 | 1 | 10 |
| Total | | 60 | 43 | 103 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 22.13592 | 15.86408 | 38 |
| | 2 | 22.13592 | 15.86408 | 38 |
| | 3 | 9.902913 | 7.097087 | 17 |
| | 4 | 5.825243 | 4.174757 | 10 |
| Total | | 60 | 43 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 30.53860 | 9.077111 | 39.61571 |
| 13.0557 | 27.79865 | 40.85436 |
| 6.462745 | 11.41313 | 17.87588 |
| 13.905 | 0.239535 | 14.14453 |

Test statistic= 112.4905 - 103 = 9.490476

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

9.49047591619269 > 7.815 = TRUE

Therefore: H0 Rejected

Test of independence value (MS Excel)= 0.023

χ^2 Test report**Result:** S.89**Variables**Variable 1: **Bureaucracy (Q10)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Bureaucracy (Q10) and Size (1-10/11+) are independent.

H1: Bureaucracy (Q10) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Scale | 1 | 21 | 6 | 27 |
| | 2 | 18 | 18 | 36 |
| | 3 | 18 | 13 | 31 |
| | 4 | 3 | 6 | 9 |
| Total | | 60 | 43 | 103 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 15.72816 | 11.27184 | 27 |
| | 2 | 20.97087 | 15.02913 | 36 |
| | 3 | 18.05825 | 12.94175 | 31 |
| | 4 | 5.242718 | 3.757282 | 9 |
| Total | | 60 | 43 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 28.03889 | 3.193798 | 31.23269 |
| 15.45 | 21.55814 | 37.00814 |
| 17.94194 | 13.05851 | 31.00045 |
| 1.716667 | 9.581395 | 11.29806 |

Test statistic= 110.5393 -103= 7.539339

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

7.53933900141702 > 7.815=

FALSE**Therefore: H0 Accepted****Test of independence value (MS Excel)= 0.057**

χ^2 Test report**Result:** S.90**Variables**Variable 1: **Bureaucracy (Q10)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Bureaucracy (Q10) and Profession (A/B) are independent.

H1: Bureaucracy (Q10) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 12 | 15 | 27 |
| | 2 | 16 | 20 | 36 |
| | 3 | 14 | 17 | 31 |
| | 4 | 4 | 5 | 9 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 12.05825 | 14.94175 | 27 |
| | 2 | 16.07767 | 19.92233 | 36 |
| | 3 | 13.84466 | 17.15534 | 31 |
| | 4 | 4.019417 | 4.980583 | 9 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 11.94203 | 15.05848 | 27.00051 |
| 15.92271 | 20.07797 | 36.00068 |
| 14.15708 | 16.84607 | 31.00315 |
| 3.980676 | 5.019493 | 9.00017 |

Test statistic= 103.0045 - 103 = 0.004506

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.00450557592360212 > 7.815 = FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 1.000

χ^2 Test report**Result:** S.92**Variables**Variable 1: **Competitiveness (Q11)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Competitiveness (Q11) and Size (1-10/11+) are independent.

H1: Competitiveness (Q11) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Scale | 1 | 23 | 8 | 31 |
| | 2 | 20 | 23 | 43 |
| | 3 | 13 | 11 | 24 |
| | 4 | 4 | 1 | 5 |
| Total | | 60 | 43 | 103 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 18.05825 | 12.94175 | 31 |
| | 2 | 25.04854 | 17.95146 | 43 |
| | 3 | 13.98058 | 10.01942 | 24 |
| | 4 | 2.912621 | 2.087379 | 5 |
| Total | | 60 | 43 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 29.29409 | 4.945236 | 34.23932 |
| 15.96899 | 29.46836 | 45.43735 |
| 12.08819 | 12.07655 | 24.16474 |
| 5.493333 | 0.47907 | 5.972403 |

Test statistic= 109.8138 -103= 6.813824

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

6.81382378782682 > 7.815= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.078

χ^2 Test report**Result:** S.93**Variables**Variable 1: **Competitiveness (Q11)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Competitiveness (Q11) and Profession (A/B) are independent.

H1: Competitiveness (Q11) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Scale | 1 | 15 | 16 | 31 |
| | 2 | 16 | 27 | 43 |
| | 3 | 12 | 12 | 24 |
| | 4 | 3 | 2 | 5 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Scale | 1 | 13.84466 | 17.15534 | 31 |
| | 2 | 19.20388 | 23.79612 | 43 |
| | 3 | 10.71845 | 13.28155 | 24 |
| | 4 | 2.23301 | 2.76699 | 5 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 16.25175 | 14.92247 | 31.17422 |
| 13.33064 | 30.63525 | 43.96589 |
| 13.43478 | 10.84211 | 24.27689 |
| 4.030435 | 1.445614 | 5.476049 |

Test statistic= 104.893 -103= 1.893045

Degrees of Freedom (DF)= (r-1)x(c-1) = 3**Critical Value of Chi-square at 0.05 and 3 DF = 7.815****Testing the null hypothesis (H0)**

Test statistic > Critical value

1.89304522927071 > 7.815= FALSE

Therefore: H0 Accepted

Test of independence value (MS Excel)= 0.595

χ^2 Test report**Result:** S.112**Variables**Variable 1: **Website (Q19)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Website (Q19) and Profession (A/B) are independent.

H1: Website (Q19) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 42 | 36 | 78 |
| | 2 | 4 | 21 | 25 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 34.83495 | 43.16505 | 78 |
| | 2 | 11.16505 | 13.83495 | 25 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 50.63880 | 30.02429 | 80.66309 |
| 1.433043 | 31.87579 | 33.30883 |

Test statistic= 113.9719 -103= 10.97192

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

10.9719204365429 > 3.841= TRUE

Therefore: H0 Rejected

Test of independence value (MS Excel)= 0.001

χ^2 Test report**Result:** S.113**Variables**Variable 1: **Website (Q19)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Website (Q19) and Size (1-10/11+) are independent.

H1: Website (Q19) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Code | 1 | 37 | 41 | 78 |
| | 2 | 23 | 2 | 25 |
| Total | | 60 | 43 | 103 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 45.43689 | 32.56311 | 78 |
| | 2 | 14.56311 | 10.43689 | 25 |
| Total | | 60 | 43 | 103 |

Test statistic

| | | |
|----------|----------|-----------------|
| 30.12970 | 51.62284 | 81.75254 |
| 36.32467 | 0.383256 | 36.70792 |

Test statistic= **118.4605** -103= **15.46046****Degrees of Freedom (DF)= (r-1)x(c-1) = 1****Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

15.4604617372292 > 3.841= **TRUE****Therefore: H0 Rejected****Test of independence value (MS Excel)= 0.0001**

χ^2 Test report**Result:** S.115**Variables**Variable 1: **Wireless network (Q20)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Wireless network (Q20) and Profession (A/B) are independent.

H1: Wireless network (Q20) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 19 | 27 | 46 |
| | 2 | 26 | 30 | 56 |
| Total | | 45 | 57 | 102 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 20.29412 | 25.70588 | 46 |
| | 2 | 24.70588 | 31.29412 | 56 |
| Total | | 45 | 57 | 102 |

Test statistic

| | | |
|-----------------|----------|--------------------------|
| 17.78841 | 28.35927 | 46.14767 |
| 27.3619 | 28.7594 | 56.1213 |
| Test statistic= | | 102.269 - 102 = 0.268977 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.26897678980059 > 3.841 = FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.6040**

χ^2 Test report**Result:** S.116**Variables**Variable 1: **Wireless network (Q20)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Wireless network (Q20) and Size (1-10/11+) are independent.

H1: Wireless network (Q20) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Code | 1 | 24 | 22 | 46 |
| | 2 | 35 | 21 | 56 |
| Total | | 59 | 43 | 102 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 26.60784 | 19.39216 | 46 |
| | 2 | 32.39216 | 23.60784 | 56 |
| Total | | 59 | 43 | 102 |

Test statistic

| | | |
|-----------------|----------|-------------------------|
| 21.64775 | 24.95854 | 46.6063 |
| 37.8178 | 18.68023 | 56.49803 |
| Test statistic= | | 103.1043 -102= 1.104326 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

1.10432554712 > 3.841= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.2933**

χ^2 Test report**Result:** S.122**Variables**Variable 1: **Printing frequency (Q24)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Printing frequency (Q24) and Profession (A/B) are independent.

H1: Printing frequency (Q24) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 15 | 22 | 37 |
| | 2 | 31 | 35 | 66 |
| Total | | 46 | 57 | 103 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 16.52427 | 20.47573 | 37 |
| | 2 | 29.47573 | 36.52427 | 66 |
| Total | | 46 | 57 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 13.61633 | 23.63774 | 37.25408 |
| 32.6031 | 33.53934 | 66.14244 |

Test statistic= 103.3965 - 103 = 0.396514

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.396513686559445 > 3.841 = FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.5289**

χ^2 Test report**Result:** S.123**Variables**Variable 1: **Printing frequency (Q24)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Printing frequency (Q24) and Size (1-10/11+) are independent.

H1: Printing frequency (Q24) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Code | 1 | 19 | 18 | 37 |
| | 2 | 41 | 25 | 66 |
| Total | | 60 | 43 | 103 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 21.5534 | 15.4466 | 37 |
| | 2 | 38.4466 | 27.5534 | 66 |
| Total | | 60 | 43 | 103 |

Test statistic

| | | |
|----------|----------|----------|
| 16.74910 | 20.97549 | 37.72459 |
| 43.72298 | 22.68323 | 66.40621 |

Test statistic= 104.1308 -103= 1.130794

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

1.13079363718899 > 3.841= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.2876**

χ^2 Test report**Result:** S.125**Variables**Variable 1: **Scanning documents (Q25)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Scanning documents (Q25) and Profession (A/B) are independent.

H1: Scanning documents (Q25) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 23 | 32 | 55 |
| | 2 | 22 | 24 | 46 |
| Total | | 45 | 56 | 101 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 24.50495 | 30.49505 | 55 |
| | 2 | 20.49505 | 25.50495 | 46 |
| Total | | 45 | 56 | 101 |

Test statistic

| | | |
|-----------------|----------|--------------------------|
| 21.58747 | 33.57922 | 55.1667 |
| 23.61546 | 22.58385 | 46.19931 |
| Test statistic= | | 101.366 - 101 = 0.366005 |

Degrees of Freedom (DF) = (r-1) × (c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.366005395570582 > 3.841 = FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel) = 0.5452**

χ^2 Test report**Result:** S.126**Variables**

Variable 1: Scanning documents (Q25)

Variable 2: Size (1-10/11+)

Hypotheses

H0: Scanning documents (Q25) and Size (1-10/11+) are independent.

H1: Scanning documents (Q25) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Code | 1 | 24 | 31 | 55 |
| | 2 | 34 | 12 | 46 |
| Total | | 58 | 43 | 101 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 31.58416 | 23.41584 | 55 |
| | 2 | 26.41584 | 19.58416 | 46 |
| Total | | 58 | 43 | 101 |

Test statistic

| | | |
|-----------------|----------|-------------------------|
| 18.23699 | 41.04059 | 59.27758 |
| 43.76162 | 7.352882 | 51.1145 |
| Test statistic= | | 110.3921 -101= 9.392083 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

9.39208345087498 > 3.841= TRUE

Therefore: H0 Rejected**Test of independence value (MS Excel)= 0.0022**

χ^2 Test report**Result:** S.143**Variables**

Variable 1: Hot-desking (Q27)

Variable 2: Profession (A/B)

Hypotheses

H0: Hot-desking (Q27) and Profession (A/B) are independent.

H1: Hot-desking (Q27) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 13 | 7 | 20 |
| | 2 | 33 | 49 | 82 |
| Total | | 46 | 56 | 102 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 9.019608 | 10.98039 | 20 |
| | 2 | 36.98039 | 45.01961 | 82 |
| Total | | 46 | 56 | 102 |

Test statistic

| | | |
|-----------------|----------|---------------------------|
| 18.73696 | 4.4625 | 23.19946 |
| 29.44804 | 53.33232 | 82.78036 |
| Test statistic= | | 105.9798 - 102 = 3.979812 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

3.9798117709438 > 3.841= TRUE

Therefore: H0 Rejected**Test of independence value (MS Excel)= 0.0460**

χ^2 Test report**Result:** S.144**Variables**Variable 1: **Hot-desking (Q27)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Hot-desking (Q27) and Size (1-10/11+) are independent.

H1: Hot-desking (Q27) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Code | 1 | 15 | 5 | 20 |
| | 2 | 44 | 38 | 82 |
| Total | | 59 | 43 | 102 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 11.56863 | 8.431373 | 20 |
| | 2 | 47.43137 | 34.56863 | 82 |
| Total | | 59 | 43 | 102 |

Test statistic

| | | |
|-----------------|----------|-------------------------|
| 19.44915 | 2.965116 | 22.41427 |
| 40.81687 | 41.77198 | 82.58885 |
| Test statistic= | | 105.0031 -102= 3.003115 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

3.00311487545304 > 3.841= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.0831**

χ^2 Test report**Result:** S.150**Variables**Variable 1: **Teleworking (Q29)**Variable 2: **Profession (A/B)****Hypotheses**

H0: Teleworking (Q29) and Profession (A/B) are independent.

H1: Teleworking (Q29) and Profession (A/B) are NOT independent.

Actual values

| | | Group A | Group B | Total |
|-------|---|---------|---------|-------|
| Code | 1 | 11 | 12 | 23 |
| | 2 | 33 | 43 | 76 |
| Total | | 44 | 55 | 99 |

Expected values

| | | Group A | Group B | Total |
|-------|---|----------|----------|-------|
| Code | 1 | 10.22222 | 12.77778 | 23 |
| | 2 | 33.77778 | 42.22222 | 76 |
| Total | | 44 | 55 | 99 |

Test statistic

| | | | |
|-----------------|----------|----------|---------------|
| | 11.83696 | 11.26957 | 23.10652 |
| | 32.24013 | 43.79211 | 76.03224 |
| Test statistic= | 99.13876 | | -99= 0.138759 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

0.13875858123572 > 3.841= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.7095**

χ^2 Test report**Result:** S.151**Variables**Variable 1: **Teleworking (Q29)**Variable 2: **Size (1-10/11+)****Hypotheses**

H0: Teleworking (Q29) and Size (1-10/11+) are independent.

H1: Teleworking (Q29) and Size (1-10/11+) are NOT independent.

Actual values

| | | 1-10 | 11+ | Total |
|-------|---|------|-----|-------|
| Code | 1 | 17 | 6 | 23 |
| | 2 | 39 | 37 | 76 |
| Total | | 56 | 43 | 99 |

Expected values

| | | 1-10 | 11+ | Total |
|-------|---|---------|----------|-------|
| Code | 1 | 13.0101 | 9.989899 | 23 |
| | 2 | 42.9899 | 33.0101 | 76 |
| Total | | 56 | 43 | 99 |

Test statistic

| | | |
|-----------------|----------|------------------------|
| 22.21351 | 3.60364 | 25.81715 |
| 35.3804 | 41.47215 | 76.85256 |
| Test statistic= | | 102.6697 -99= 3.669708 |

Degrees of Freedom (DF)= (r-1)x(c-1) = 1**Critical Value of Chi-square at 0.05 and 1 DF = 3.841****Testing the null hypothesis (H0)**

Test statistic > Critical value

3.66970771531966 > 3.841= FALSE

Therefore: H0 Accepted**Test of independence value (MS Excel)= 0.0554**