LIVING WITH ENTERPRISE RESOURCE PLANNING (ERP):
AN INVESTIGATION OF END USER PROBLEMS AND COPING MECHANISMS

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ABSTRACT

The need for real time and integrated computing and information environment to support and enhance business operations has motivated companies to introduce Enterprise Resource Planning (ERP) systems. ERP systems present a holistic view of a business from single information and IT architecture. However, the euphoria around ERP systems is wearing off and it has become clear that ERP systems do not automatically deliver business value. One of the reasons for this is the challenges and problems that organisations and their ERP users face in both the deployment and use of ERP. As such, successful implementation of an ERP system does not necessarily guarantee that the system will be comprehensively used or accepted by users of the system. ERP benefits can only be realised and sustained if users continue to have favourable experiences in using the system. While many previous studies have examined ERP problems during the implementation phase, only a few have revealed problems during the post-implementation use phase. Additionally, prior research has tended to focus more on analysing organisational rather than individual perspectives. Because of these gaps in post-implementation ERP research, the aim of this study is to investigate the problems that end users face while using ERP, the antecedent factors behind the identified problems and the various coping mechanisms employed by end users to overcome the problems.

To achieve the aim, this research was guided by the ‘soft-positivism’ paradigm, a paradigm that combines elements of positivism and interpretivism. By using this paradigm, the investigator brought certain prior expectations to the data analysis which are consistent with positivist research and which also build rich explanations from the data, consistent with the interpretive assumption. First, a review of the literature and an exploratory study were undertaken to: (1) explore the extent of previous work on ERP problems during post implementation, (2) identify some of the known influencing factors on ERP usage problems and (3) gain insight into the strategies for dealing with ERP problems. Based on the results of the literature review and the exploratory study, and drawing from the two theoretical frameworks of Task-Technology Fit and Gap Framework, a preliminary conceptual framework was developed.
A qualitative approach using multiple case studies was followed to conduct the empirical research. Three Malaysian organisations that had implemented ERP were investigated by conducting 30 semi-structured interviews, reviewing archival records and documents, and observation. The interviews were guided by the research objectives and the initial conceptual framework. Data were analysed by using open and thematic coding.

The findings indicated four major areas of ERP usage problems: system, data, and technical infrastructure and interface problems. Besides that, several antecedent factors to the problems were identified. These factors fall into four major categories: organisation, user, task and technology, and include lack of support from either external or internal expertise, lack of individual strength and limited technology affordance. To cope with these problems, users rely on feral use of information technology, feral information systems and feral data.

The findings led to developing an original End Users’ Usage and Coping Mechanisms Model (EUPCOM Model) and 14 research propositions that will facilitate future study. The research contributes to practice by offering recommendations to managers as well as other ERP practitioners about the possible problems to anticipate while using ERP; actions to consider to minimise the factors that contribute to these problems; and how to improve users’ experiences with an ERP system.
DECLARATION OF ORIGINALITY

I certify that except where due acknowledgement had 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 this 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.

Signed: ________________________________ on: ________________________________
PUBLICATIONS


ACKNOWLEDGEMENTS

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I would like to make special mention of the School of Business IT and Logistics, RMIT University for providing administration and various interesting platforms of scholarship (series of colloquiums, workshops and three-minute PhD competitions), RMIT School of Graduate Research and RMIT Business Research Unit for providing financial support, and also my employer, University Teknologi MARA (UiTM), for giving me study leave and financial assistance.

I would also like to acknowledge the staff members who were either directly or indirectly involved in my case studies research, namely, Case A and Case C of PATRON’s BERHAD, and also Case B (ING CORPORATION BERHAD). And special thanks goes to Encik Alias Mamat, a Senior Manager of the Engineering and Services Department, Puan Sazila Tajul Urus, an Executive of the Plant Operation Department, Cik Nuraini Zakaria, an Executive of the Human Resource Management and Administration Department of Case A, Puan Farah Dato Rameli, a Senior Manager of the MIS & SAP Department of Case B, and Encik Khyrun Anuar Zainol, a Manager of Group Training and Development of Case B.
DEDICATION

I dedicate this thesis to the most important people in my life. These people have shared with me a life worth living. They are my beloved parents, my much-loved husband, my treasured children, my siblings and my friends. First, I would like to thank my parents for bringing me into this world, my dad, Haji Tajul Urus bin Taib, and my loving mother, Hajjah Patamah binti Hassan. Mom and Dad, I owe you everything. In spite of my stubbornness among other siblings, you raised me up with love and prayers throughout these years of mine.

I am so thankful to my dearest husband, Abu Hassan bin Ibrahim. Darling, words cannot express how much I am indebted to you. Your endless love and support keep me moving through my hardest time of life, when it seems unreachable for me to reach my destiny. You are always at my side to give me your love, strength, support, patience and understanding. Your endless encouragement has allowed me to complete this long and demanding journey. Thank you!

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Not forgotten, my special gratitude goes to all of my friends at RMIT, UiTM and elsewhere, especially to Siti, Fadz, Sha, Umar Su, Ila, Taha, As, Mila – and the list goes on. To Fadz, thank you for always believing in me!
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<td>ACM</td>
<td>Automotive Component Manufacturing Division</td>
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<td>BOM</td>
<td>Bill of Material</td>
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<td>CBCD</td>
<td>Case B Group Finance and Corporate Division</td>
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<td>CBSC</td>
<td>Case B Subsidiary Company</td>
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<td>CEO</td>
<td>Chief Executive Officer</td>
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<td>CFFs</td>
<td>Critical Failure Factors</td>
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<td>CIDU</td>
<td>Corporate Information Development Unit (KL)</td>
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<td>CO</td>
<td>Cost Controlling Module</td>
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<tr>
<td>COSO</td>
<td>Committee of Sponsoring Organisations of Treadway Commission</td>
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<tr>
<td>CPD</td>
<td>Corporate Planning Development Unit (KL)</td>
</tr>
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<td>CPU</td>
<td>Cost per Unit</td>
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<td>CSE</td>
<td>Computer Self Efficacy</td>
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<td>DMS</td>
<td>Document Management Systems</td>
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<td>DOI</td>
<td>Diffusion of Innovation Theory (DOI)</td>
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<td>DQ</td>
<td>Data Quality</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<td>End Users' Usage and Coping Mechanisms Model</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>IMPS</td>
<td>Integrated Maintenance and Planning Support</td>
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<td>IS</td>
<td>Information Systems</td>
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<td>LIMS</td>
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<td>MFO</td>
<td>Material Forecast Order</td>
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<td>MIS and SAP</td>
<td>Management Information Systems and SAP Department</td>
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<td>Abbreviation</td>
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<tr>
<td>MTBF</td>
<td>Mean Time between Failures</td>
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<td>Material Resource Planning</td>
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<td>OPI</td>
<td>Operating Performance Improvement Department</td>
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<td>OPU</td>
<td>Operating Unit</td>
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<td>PATRON</td>
<td>Petroleum National Berhad</td>
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<td>PASB</td>
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<td>PERMATA</td>
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<td>Petronas Fertilizer Kedah</td>
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<td>PM</td>
<td>Plant and Maintenance Module</td>
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<td>PMMS</td>
<td>PETRONAS Maintenance Management System</td>
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<td>PP</td>
<td>Production and Planning Module</td>
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<td>PPC</td>
<td>Production Planning and Control Department</td>
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<td>PPIC</td>
<td>PATRON Industry Complex</td>
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<td>Purchase Requisition</td>
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<td>Purchasing and Vendor Development Department</td>
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<td>SAP</td>
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<td>SAP Real-time Three Tier Architecture</td>
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<td>Supply Chain Management</td>
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<td>Sales and Distribution</td>
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<tr>
<td>TAM</td>
<td>Technology Acceptance Model</td>
</tr>
<tr>
<td>TES</td>
<td>Technical Services Department</td>
</tr>
<tr>
<td>Triple M</td>
<td>Material Management Module</td>
</tr>
<tr>
<td>TTF</td>
<td>Task-Technology Fit Theory</td>
</tr>
<tr>
<td>ROIC</td>
<td>Return on Invested Capital</td>
</tr>
<tr>
<td>VBMS</td>
<td>Value Based Management Systems</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 OVERVIEW OF THE CHAPTER

This study aims to address the current knowledge gaps in the post-implementation ERP literature by investigating post-implementation ERP usage problems, the antecedents of the problems and the coping mechanisms employed by end users in dealing with ERP usage issues.

The chapter is organised in seven sections. First, the background of the research problem is presented by highlighting the research gaps (1.2). Then, the formulation of research questions and objectives is presented (1.3). Next, the importance and relevance of this research to information system research and particularly to post-implementation ERP system research is illustrated (1.4). This is followed by a summary of the research assumption and approach (1.5), the findings (1.6) and the contributions of the thesis (1.7). The chapter concludes with the organisation of the overall thesis structure (1.8).

1.2 BACKGROUND TO THE RESEARCH PROBLEM

The globalisation of economies empowered by information technology (IT) has fostered an unprecedented movement towards the integration of information systems that is evident through the deployment of Enterprise Resource Planning (ERP) systems worldwide. ERP systems, which are cross-functional IS packages, emerged in the 1990s as an essential solution that aims to seamlessly integrate and manage the different business processes and information flows within an enterprise (Boudreau 2003; Ragowsky & Gefen 2008). ERP systems combine accounting, finance, procurement, warehouse and human resource functions into a single, integrated software program that runs on only one database so that various departments can easily share information and communicate with other functions (Nah, Zuckweiler & Lau (2003). The literature has produced a well-agreed definition of what constitutes an ERP system. In his influential article in 1998, Davenport described enterprise systems as ‘commercial software packages that promise the seamless integration of all the information flowing through a company’ (Davenport 1998, p. 121). According to him, this
Integrated system (ERP) serves as the single best way for businesses to use their entire data and information resources to better manage their business.

From the development of an extended ERP system, an organisation can exploit technological advances in the areas of internet and e-business technologies (Hsu 2013) and support inter-organisational processes on an extended network of suppliers and distributors (Wang, Xie & Zhao 2012). The potential benefits that an ERP system offers have been able to attract many organisations. Some of these benefits include improved coordination (Alsene 2007), reduced inventory costs and a related reduction in the cost of capital (Rikhardsson & Kreemmergaard 2006), efficient use of information leading to profitability (Bendoly et al. 2009) and enhancement in firm competencies of supply chain management through operational process integration and customer relationship interaction (Su & Yang, 2010). This is demonstrated by ERP becoming the fastest growing market in the business software industry. From the insights of the recent ERP system Market Share Analysis report by Pang et al. (2012), the overall ERP market in 2012, grew more than 2.2% in 2011 and SAP is leading the worldwide market with 24.6% market share of the total ERP software revenue in 2012, followed by Oracle and Sage (see Figure 1.1).

Figure 1.1

Worldwide ERP Software Market Share, 2012
Market Size: $24.5B; 2.2% Growth Over 2011

Source: Pang et al. 2012
There are two distinct phases or waves in the ERP transformation process (Deloitte 1999). The first wave starts with securing ERP’s necessary tools, followed by system implementation and finalised by the ‘go live’ stage. The second wave refers to actions that are taken after ERP have been implemented, also known as the post-implementation phase. In addition to Deloitte (1999), Markus & Tanis (2000) have also recognised four phases in the ERP experience cycle: project chartering (phase I), project configuration and roll-out (phase II), shakedown (phase III) and onward and upward (phase IV) (Markus & Tanis 2000).

The first phase of chartering involves decisions defining the business case and solution constraints. The second phase, configuration and roll-out, pertains to getting system and end users ‘up and running’. This is followed with the third phase of shakedown, which refers to stabilising, eliminating ‘bugs’ and achieving normal operations. The fourth phase, which is onward and upward, involves maintaining the system, supporting users, getting results and upgrading process (Markus & Tanis 2000 p. 189). Based on Markus & Tanis’ (2000), ERP Experience Cycle, phases III (shakedown) and IV (onward and upward) both belong to the post-implementation stage (Markus & Tanis 2000, p. 189). Following system implementation, an organisation would engage in a number of activities such as a post-implementation review, support and maintenance (Gelinas & Sutton 2002). However, a mistake made by most companies is to view the ‘go live’ point as the final goal (Faleti 1998; Willis & Willis-Brown 2002).

A considerable amount of literature has been published on ERP research. While the emphasis of information systems (IS) scholars so far has been on the adoption, the implementation process and the critical success factors, some researchers have moved beyond the adoption and implementation phases into the post-implementation phase of ERP (Addo-Tenkorang & Helo 2011; Esteves & Bohorquez 2007; Grabski, Leech & Schmidt 2011; Moon 2007; Schlichter & Kraemmergaard 2010; Yu 2005). For example, reviews of previous studies For example, reviews of previous studies by Coa, Nicolou & Bhattacharya (2013); Moon (2007), Esteves & Bohorquez (2007) Ghosh, Yoon,& Fustos (2013); and Grabski, Leech and Schmidt (2011) suggested that the majority of existing ERP literature focuses on the selection and implementation and not on post-implementation ERP research. As such, the post-implementation phase is taken relatively too lightly by both researchers and enterprises, although it is understood that the implementation process alone does not complete an ERP project. Once a company successfully implements an ERP system, attention moves to the most efficient use of the ERP system (Cao, Nicolaou & Bhattacharya 2013; Grabski, Leech & Schmidt 2011; Moon 2007).
Post-ERP-implementation research, especially on the usage and evaluation phase, is gaining emerging importance (Botta-Genoulaz, Millet & Grabot 2005; Esteves & Bohorquez 2007; Moon 2007; Olson, Chae & Sheu 2013; Schlichter & Kraemmergaard 2010).

Nonetheless, the emphasis of the existing studies is placed on the evaluation of the benefits and antecedents to ERP success. A number of studies have examined the impacts of ERP on post-implementation performance outcome, such as the study of Zhu et al. (2010), who found that the quality of implementation and organisational readiness influence post-implementation success. Other studies have focused on the strategic, managerial, operational and organisational benefits resulting from ERP implementation (Esteves 2009; Shang & Seddon 2000; Shang & Seddon 2002) and how these benefits evolve over the post-implementation period (Staehr 2010). Others have proposed a research model or framework to analyse ERP system benefits (Esteves 2005; Shang & Seddon 2000).

Apart from those studies, very few authors have focused on the ERP maintenance activities, the post-implementation activities undertaken from the time the system goes live until it retires from production. Proper ERP maintenance is a condition that is necessary to achieve the benefits expected of ERP system. For instance, Lopez & Salmeron (2014) built a dynamic risk modelling called Fuzzy Cognitive Maps (FCMs) that was intended to assess the effects of ERP system during post implementation phase by identifying the potential risks which affect the outcomes of ERP maintenance projects. Ng, Gable and Chan (2003) conducted a case study of a large organisation that implemented ERP. They proposed a benefits-oriented taxonomy that better represents ERP maintenance activities, including ERP enhancement. Some studies have examined the process of system review during the post-implementation stage of an ERP implementation (Nicolaou 2004; Nicolaou & Bhattacharya 2006, 2008). Nicolaou (2004) suggested that ERP post-implementation success could be determined through a planned set of review/evaluation activities.

Despite a large number of previous studies examining ERP system problems during the implementation phase, few reveal problems encountered by end users during the post-implementation phase. The term ‘problems’ refer to problems or issues of ERP system either prior to the implementation, during or after the implementation stage. For example, amongst the notable problems during the implementation phase include ‘top management support’, ‘ERP teamwork and composition’, ‘project management’, and ‘change management culture and programme’ (Ngai, Law & Wat 2008). However, in this thesis context, the scope of the problems refers to ERP system problems faced by end users during the post implementation phase. In line with study by Ram and Pattinson (2009) and,
who reported on the limited study of the ERP post-implementation or usage stage. The problems end users encounter during the post-implementation phase of ERP could result in failure to achieve the potential benefits of ERP. For instance Ruivo et al. (2012) postulated that the benefits of ERP system reside in how organisation use and exploit the integration capabilities (both data and process) after the implementation phase. There is, therefore, a need for research to understand the problems ERP users face in using the system, the causes of those problems and how users cope with those problems.

1.3 RESEARCH QUESTIONS AND RESEARCH OBJECTIVES

This research seeks to contribute to the post-implementation ERP system research by investigating ERP usage issues. Hence, the purpose of this study is to explore different problems encountered by ERP end users and explain the antecedent factors or the drivers behind these problems as well as the coping mechanisms employed by users in dealing with ERP issues. Therefore, the main research question is:

What kind of problems do users encounter in using an ERP system and how do users cope with ERP usage problems?

In addressing the primary question, the study attempts to answer the following sub-questions:

1. What kind of problems do users (operational, supervisory and managerial) face in using ERP systems during the post-implementation phase?
2. Why do users (operational supervisory and managerial) face problems?

Identifying and exploring the usage issues and their causal factors alone are not sufficient to address the various problems that hinder the effective usage of ERP system. Therefore, the third sub-question is:

3. How do users (operational, supervisory and managerial) cope with ERP usage problems?

Against the backdrop of these research questions, this research intends to achieve the following specific objectives:

1. To develop a classification of ERP usage problems.
2. To determine the factors and processes that lead to ERP usage problems.
3. To identify the coping mechanisms to overcome ERP usage problems.
4. To develop a conceptual model of End User Problem, Antecedent Factors and Coping Mechanisms.
5. To suggest the appropriate research proposition based on the research findings and the revised conceptual model.
6. To offer contributions to theory and practice based on the research findings.

The next section outlines the research approach to attain these objectives.

1.4 RESEARCH RATIONALE

A number of reasons justify the importance of this study. First, a focus on ERP usage problems will identify knowledge that will facilitate the continuing use of ERP, which is an essential and necessary condition for achieving a return on ERP investments. Most of the previous studies tend to emphasise the problem of ERP implementation (ERP roll-out), but not the usage issues after the ERP system has been implemented (post-implementation phase). Esteves and Bohorquez (2007), Schlichter and Kraemmergaard (2010) and Grabski, Leech and Schmidt (2011) all highlighted a greater number of publications on the implementation phase. They suggested that study of the implementation phase is 47% higher than other phases. This corresponds to the focus of ERP systems research that is dominated by ERP implementation problems (Addo-Tenkorang & Helo 2011; Moon 2007; Schlichter & Kraemmergaard 2010).

Second, identifying the factors that affect users’ ability to use the ERP system effectively will help organisations save time and money. The majority of post-implementation ERP research takes an organisational rather than an end-user perspective. Post-implementation ERP studies from end users’ perspectives are rare. Existing end-user-specific studies tend to focus on adoption (Amoako-Gyampah 2007; Chang, M-K et al. 2008) or usage (Kwahk & Ahn 2010; Longinidis & Gotzamani 2009), usually in the framework of the Technology Acceptance Model (TAM) or the Diffusion of Innovation Theory (DOI). A few focus on users’ absorptive capacity (Park, Suh & Yang 2007). In the context of ERP, where usage tends to be mostly obligatory rather than voluntary, user absorption of ERP systems is critical. This is because without user satisfaction, the success of any information system is not possible (Chang, M-K et al. 2008). The existing research on the adoption of ERP provides only limited insight into the difficulties and challenges that end users encounter in using an ERP system.
Third, some important lessons could be drawn from the coping mechanisms adopted by end users when dealing with ERP system issues. For an organisation to gain maximum benefits from ERP implementation, the system must be effectively and extensively used by end users. Previous literature has highlighted the negative effects of usage problems on individuals such as frustration and lost work time (Ceaparu et al. 2004). Yet identifying the problem is not sufficient to overcome the usage issues. Attention must also be directed to recognising available alternatives to end users in the form of coping mechanisms.

1.5 RESEARCH METHODOLOGY AND APPROACH

The underlying philosophy guiding this research is the soft-positivism paradigm (Kirsch 2004; Leidner, Pan & Pan 2009). By using this paradigm, this research assumes that the studied phenomena are relatively stable. Objectively that is consistent with the positivist view. Nevertheless, the approach of this study is not limited to examining the pre-identified construct (based on the initial conceptual framework); it also allows for other constructs to arise from the data in line with the interpretive point of view.

Since this study design is intended to reveal pre-existing phenomena and the relationships between them – ERP system usage problems and interrelation with the antecedent factors and coping mechanisms – it is aligned with a positivist assumption that assumes the phenomena to be relatively objective and to represent a factual account of the case (Benbasat, Goldstein & Mead 1987; Yin 1994). However, at the same time, the study also draws from an interpretivist point of view (Klein & Myers 1999; Walsham 1993), enabling preservation of openness to the field data to a considerable degree. Consequently, this study anticipates that some constructs of the ERP system problems and coping mechanisms will surface from the collected data.

This study uses a multiple case study approach. The case study research design fits well with this research because the researcher needs to delve deep to gain an understanding of ERP usage problems, the factors behind the problems and how users cope with these usage issues. Therefore, a qualitative case study was selected as the research method. The study was conducted in two stages: the exploratory study and the main study. The overall research design is presented in Figure 1.2.
Chapter 1: Introduction

Figure 1.2: Overall Research Design

Notes:
- The flow of the research process. It begins with a review of literature up to the conclusion.
- The purpose or aim of the designated steps
- Questions during the stage
1.6 FINDINGS OF THE STUDY

The research findings revealed four major areas of ERP usage problems: system, data, technical infrastructure and interface problems. Several antecedent factors that cause end users’ problems were identified. These factors are grouped into four major categories: organisation, user, task and technology. The identification of the antecedent factors was shaped from the initial conceptual framework based on the Task-Technology Fit theory, the Gap Framework and the Computer Self-Efficacy concept. It was also found that feral use of information technology, feral information systems and feral data (derived from the first two) are the types of coping mechanisms employed by end users in dealing with the ERP system. These findings led to a revised model called the End Users’ Usage and Coping Mechanisms Model (EUPCOM Model) (see Figure 6.1). The EUPCOM Model illustrates the complex relationships between usage problems, antecedent factors and coping mechanisms. These relationships led to 14 propositions related to the three research questions.

1.7 CONTRIBUTIONS OF THE STUDY

This study contributes to the literature on many aspects of the theory and practice of ERP.

First, from the review of the literature, this study establishes the gap in the existing body of knowledge. Second, through a methodical review of the prior literature, this study bridges the gaps identified in Section 1.3 by highlighting the challenges that end users face in using the system. Third, this thesis proposes a theoretically grounded framework in the form of an original End User Problem and Coping Mechanisms (EUPCOM) Model. The model provides insight into what hinders the effective use of ERP by integrating the antecedent factors to the problems and the deployment of coping mechanisms. The study also provides empirical support to the use of Task-Technology Fit and Gap Framework in identifying the factors that explain ERP usage problems. Fourth, from the empirical evidence of this study, 14 research propositions have been formulated that could be examined further by future research.

This study is important, as the results offer some recommendations to managers as well as other practitioners on the possible problems arising from the use of an ERP system. Suggestions are also made to organisations that have implemented an ERP system on how they could institute actions to recognise potential ERP system problems that originated during the early phase of implementation. An unsolved system problem in the early phase of
ERP system implementation may lead to a greater problem for end users during the post-implementation phase. Additionally, by focusing on the problematic aspects of SAP system usage, this thesis suggests that there are many lessons to be learnt on how to minimise system usage drawbacks through their antecedents factors in order to improve users’ interaction with the technicality of an ERP system.

1.8 ORGANISATION OF THE THESIS

The remainder of the thesis is organised into six chapters. Chapter 2 presents a review of relevant background literature, drawing from ERP and IS literature. The chapter examines seminal works on ERP system usage, highlights some of the known factors that affect ERP system usage, and identifies coping strategies and practices in dealing with ERP.

Chapter 3 sets out to develop the initial conceptual framework. The chapter presents the results from the exploratory study and the literature review that become the basis of the identification of the relevant constructs used for the end users’ problems and coping mechanism domains. The relevant concepts and construct used for the antecedent factors domain is drawn from the Task-Technology Fit (TTF) theory, the Gap Framework and the Computer Self-Efficacy concept.

Chapter 4 focuses on the research methodology. The chapter starts with the epistemological assumptions of this research. Then the discussion covers the qualitative research method employing the case study research design approach. This chapter also describes and justifies the data collection methods employed in this research, namely, the interview and the document review. This research specifically takes a soft-positivism perspective, conducting interviews for collecting data and employing open and thematic coding as the analytic approach. The chapter also discusses the key ethical considerations involved in the study.

Chapter 5 presents the qualitative data analysis results from three individual case studies (Cases A, B and C). The within-case analysis is presented with three report sections: Case Study 1 (A), Case Study 2 (B) and Case Study 3 (C). Each of these reports discusses in detail the findings from each case. The case study report starts with the background information of the case and is followed by the findings analysis of the main research question and the three sub-questions.
Chapter 6 presents a discussion on the three cases. This chapter covers a cross-case analysis. The comparison between the three cases is presented in terms of similarities and differences in the three cases, A, B and C. The chapter specifically covers the discussion of a model of ERP Usage Problems, Antecedents and Coping Mechanisms (EUPCOM Model). The model is based on the three conceptual domains of the initial conceptual framework: end users’ problems, antecedent factors of end users’ problems and coping mechanisms. The discussion of the EUPCOM Model leads to fourteen research propositions to illustrate the complex relationships between these three factors.

Finally, the thesis offers an overall conclusion in Chapter 7. The conclusion draws together the key findings of the three cases, revealing the unique contribution of this research. This chapter reflects on the theoretical and practical implications of this study by summarising the research questions, stating what the research has achieved and highlighting the results from the empirical work. Towards the end of the chapter, some recommendations are made and the chapter concludes with a discussion on the limitations of the research.
Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

In Chapter 1, the emerging number of studies on post-implementation of an ERP system was noted. Nevertheless, there is still a lack of theoretical frameworks and a lack of empirical evidence for understanding the problems during this stage from the users’ perspectives. Hence, there is a need for new research to redefine existing knowledge and to offer a theoretical framework that is able to explain different classifications of usage problems encountered by end users and to present the antecedent factors of these problems. Additionally, this chapter reviews the relevant studies of coping strategies employed by end users in dealing with usage problems. In view of the fact that the ERP system is a subset of legacy IS, the review of related literature is not drawn just from the ERP research field but also from the legacy IS literature.

This chapter which reviews the pertinent literature is organised into five sections. A review of the seminal work on ERP system usage is presented in Section 2.2. This section defines system usage and provides insight into some of the ERP system usage issues. Section 2.3 outlines the streams of factors that affect ERP system usage by examining different theoretical approaches used to explain these factors. Section 2.4 presents some of the practices and strategies employed by end users in dealing with ERP usage issues. Section 2.5 provides a summary of the chapter. The synthesis of prior studies described in this chapter also identifies some research gaps for the exploratory study and sets the direction for the development of the initial conceptual model, both of which are presented in Chapter 3.
2.2 ERP SYSTEM USAGE

System usage has played a major role not only in the specific ERP system context, but also in the IS literature. According to Davis (1989), ‘system usage’ implies the duration, frequency and intensity of interaction of users (employees) with the system. Burton-Jones and Straub (2006) proposed that system usage comprises three major elements: (1) a user – the subject using the IS, (2) a task – the function being performed and (3) a system – the object being used (see Figure 2.1).

![Figure 2.1: The Concept of System Usage](image)

**Source:** Burton-Jones & Straub (2006)

Burton-Jones and Straub (2006) proposed that individual-level system usage refers to an individual employing one or more features of a system to perform a task. With regard to this, ‘a user’ refers to a person who uses the ERP system, which includes novice users and expert users. ‘A user’ can be described as an individual or multiple groups of users who are involved with the task and system. ‘A task’ is defined as ‘an activity performed to reach a certain goal’ (Van Welie, Van Der Veer & Eliëns 1998). ‘A task’ is also often called ‘activity’ or ‘work’. It takes place over a period of time and generally consumes resources. Tasks are executed in a certain order and the completion of one task can trigger the execution of one or more other tasks (Van Welie, Van Der Veer & Eliëns 1998). In the context of an ERP system, a task requires a mix of cross-functional strategic planning and enterprise-wide corporate diplomacy (Bingi, Sharma & Godla 1999). Technologies are viewed as tools used by individuals in carrying out their tasks (Goodhue 1995). ‘Technology’ from the ERP perspective is viewed as ‘the integrated set of computer programs designed to serve a particular function that has specific input, processing and output activities’ (e.g., general ledger, manufacturing resource planning, human resource management) (District 2007). ‘A system’ is defined as including hardware, software, application, tool or a combination of these technologies. From the technical perspective, ‘ERP systems’ are
technologically sophisticated information systems (IS) that require more technical knowledge to adopt than traditional transaction-processing systems (Kwahk & Ahn 2010).

Noting the importance of system usage, DeLone and McLean (2003) contended that effective system usage is a major determinant of productivity. ‘Quality of use’ is defined as the ability of end users to exploit the appropriate capability of a software in a correct manner in the most relevant circumstances (Boudreau 2003). Hence, the use of an information system is reliant on the user’s interpretation and practices rather than being predetermined (Orlikowski 2000). The effectiveness of the investment in an information system (IS) can be partly explained by the continuing usage of installed systems. IS continuance research ranges from the employment of IS adoption as an independent variable for explaining IS continuance (Chiu et al. 2005) to the study of IS continuance in the mandatory environment (Sørebø & Eikebrokk 2008).

ERP system usage is a significant element in system success, where the triumph of ERP is indeed dependent upon actual system use (Aloini, Dulmin & Mininno 2007, 2012; Khalid et al. 2013). Therefore, previous studies urged that even if an ERP system had been developed successfully from the technical point of view, users’ reluctance to use it would hinder the expected promised benefits (Aladwani 2001; Kwahk & Ahn 2010; Kwak et al. 2012). ERP system benefits can only be realised if users continue to use the system. This echoes the findings of Grandlund and Malmi (2002), who claimed that faster working practices as a result of ERP are dependent entirely on the system’s users. Similar arguments were made by Arnold et al. (2004) that ‘smart systems’ like ERP systems require smart users to be of real value. Therefore, users who do not understand the system may not be able to succeed in using it since they cannot be expected to learn from their experience (Arnold et al. 2004).

For a highly integrated system like ERP, system problems occur not only while using the system but also originate from the early phase of system implementation. A previous study reported that eight out of nine ERP problems originated from performance-related problems and flawed technology (Gale 2002). The factors that lead to failure of ERP system implementation, also known as Critical Failure Factors (CFFs), have been extensively explored in the past. For instance, the search through the empirical literature done by Ngai, Law and Wat (2008) showed that the notable and frequently cited CFFs included ‘top management support’, ‘ERP teamwork and composition’, ‘project management’, and ‘change management culture and programme’. Their result is consistent with the work of Nah Zuckweiler and Lau (2003), which evaluated
these four factors and rated them as most critical to the success of ERP implementation. Some researchers have also suggested poor project management, users' resistance to change, poor user involvement, a high attrition rate of project team members, inadequate project team composition, ineffective organisational change management and unrealistic project scheduling, lack of education and training, unrealistic expectations about implementation, inaccurate data, mismatch between the business and ERP system selected, technical difficulties, operation being costly and time consuming, and technical complexity as reasons for the failure of ERP system implementation (Amid, Moalagh & Zare Ravasan 2012; Garg & Garg 2013; Nah, Zuckweiler & Lau 2003; Ngai, Law & Wat 2008).

Although extensive research has been carried out relating to problems affecting an ERP system during the implementation phase, limited studies have been conducted with respect to the problems during the post-implementation stage, despite the fact that user adoption issues have also been found to be the major cause of implementation failure (Kwak et al. 2012; Soja & Paliwoda-Pekosz 2009). As cited previously, apart from the complex nature of the ERP system, user-related factors are considered critical risk factors for an ERP system (Bueno & Salmeron 2008; Luo & Strong 2004; Migdadi 2009). Therefore, even if an ERP system has been installed on time and within the organisation's budget, it is undesirable if users perceive the system as useless for their work processes or need to spend a long time in working out how to use it. The following section reviews the literature on some of the known ERP use problems.

2.2.1 ERP System Usage Problems

From the synthesis of the legacy IS and ERP system literature, current researcher has classified ERP system usage problem into four major categories. This classification is needed for the purpose of discussion. These four classifications are (1) system-related problems, (2) data-related problems, (3) infrastructure-related problem and (4) interface-related problems. The review of the legacy IS and ERP literature identifies these four classifications of ERP system usage problems during the post implementation phase: (1) system-related problems, (2) data-related problems, (3) infrastructure-related problems and (4) interface-related problems.
### Table 2.1: A Summary of Literature on Problems of ERP Systems

<table>
<thead>
<tr>
<th>Reference</th>
<th>Research Method</th>
<th>Theory/Frame-work</th>
<th>Domain of Literature</th>
<th>System-Related Problem</th>
<th>Data-Related Problem</th>
<th>Infra-structure-Related Problem</th>
<th>Interface-Related Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lv &amp; Chen (2010)</td>
<td>Literature Review</td>
<td>Return of Investment (ROI)</td>
<td>ERP (Imp)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Markus et al. (2000)</td>
<td>Case Study &amp; Experiment-al Design</td>
<td>ERP Experience Cycle</td>
<td>ERP (Imp/Post Imp)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Table 2.1: A Summary of Literature on Problems of ERP Systems (Continued)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Research Method</th>
<th>Theory/ Framework</th>
<th>Domain of Literature</th>
<th>System-Related Problem</th>
<th>Data-Related Problem</th>
<th>Infrastructure-Related Problem</th>
<th>Interface-Related Problem</th>
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</thead>
<tbody>
<tr>
<td>Schoenherr et al. (2010)</td>
<td>Case Study</td>
<td>Grounded Theory Approach</td>
<td>ERP</td>
<td>X</td>
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<td></td>
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<tr>
<td>Usher &amp; Olfman (2009)</td>
<td>Case Study</td>
<td>The Maturity Model</td>
<td>ERP</td>
<td></td>
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<tr>
<td>Xu et.al (2002)</td>
<td>Case Study</td>
<td>DQ Framework</td>
<td>ERP (Imp)</td>
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<td>X</td>
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</tbody>
</table>

*Imp* *Implementation phase*,  *Post Imp* *Post Implementation Phase*
Table 2.1 illustrates the extent of previous literature on ERP system usage problems that belong to these four classifications. A summary suggests that a majority of the ERP usage problems are system-related issues, followed by data, interface and infrastructure-related problems. Next, each category of the problems is further described.

2.2.1.1 System-Related Problems

The literature has identified ERP system quality, misfit, complexity and usability as major ERP system-related problems (Deng & Chi 2012; Elbertsen, Benders & Nijssen 2006; Lin, H-F 2010; Soja & Paliwoda-Pekosz 2009; Topi, Lucas & Babaian 2005). While some researchers have looked at factors that influence an organisation’s use of an ERP system and the nature of the difficulties experienced during ERP system adoption in the ERP system context (Elbertsen, Benders & Nijssen 2006; Soja & Paliwoda-Pekosz 2009), other studies such as that by Deng and Chi (2012) have examined the construct of system usage problems from a legacy IS perspective.

A generic ERP system usage problem pertains to system quality issues. System quality in an ERP system measures a functional feature of the system and is regarded as one of the central dimensions of IS success (DeLone & McLean 2003). According to DeLone and McLean (2003), system quality measures technical success, which is the accuracy and efficiency of the IS that produces information, and information quality assesses semantic success, referring to the extent to which the information conveys the intended meaning. The system quality issue needs to be addressed urgently in order to avoid unfavourable results and in a worst case scenario, system failure.

In the context of an ERP system, Lin (2010) suggested that the usage of an ERP system is affected by the system quality. Thus, system quality measurements represented by system reliability, response time, flexibility, integration and convenience of access are among the important considerations for the user. Lin (2010) added that user satisfaction would increase when there is high-quality system design (including functionally based features). Therefore, system quality and user perceptions of usefulness can help increase user satisfaction with the ERP system and thus influence ERP system usage.
Despite the fact that system quality is used to illustrate general system-related problems, some of the problems categories were also used for specific types of system-related issues. For example, DeLone and McLean (2003) and Nelson, Todd and Wixom (2005) suggested that system quality issues relate to reliability, response time, flexibility, integration and accessibility. System error is another type of system quality highlighted by other researchers (Deng & Chi 2012; Soja & Paliwoda-Pekosz 2009). System error encompasses problems related to missing a report variable, outdated value in a configuration table, system malfunctioning, missing system features, system non-responsiveness and others that led to unsuccessful ERP system usage incidents (Deng & Chi 2012).

The other system–related problem is **system misfit**, as suggested by Soja and Paliwoda-Pekosz (2009), which is inclusive of general system misfit, functional deficiency and customisation. A functional fit problem of the ERP system indicates an inadequate amount of customisation and the additional development needed for a close fit to intended processes or customer requirements. Therefore, the functional fit of an ERP system is preferred to functionality, since superfluous functionalities bring nothing but unnecessary complexity to users (Karsak & Özogul 2009) and thus lead to system complexity issues.

To fully exploit the capabilities of complex technologies such as ERP systems, businesses must deliberately foster technology acceptance by end users. Therefore, an organisation should recognise the complexity of factors that influence individuals’ perceptions, intentions and usage of information technology such as ERP. With regard to this, one category of system-related problems cited by a number of previous researchers is **system complexity** issues (Elbertsen, Benders & Nijssen 2006; Lv & Chen 2010; Schoenherr et al. 2010; Soja & Paliwoda-Pekosz 2009; Topi, Lucas & Babaian 2005).

For example, Schoenherr et al. (2010, p. 642) proposed that ERP system complexity is a multi-dimensional construct consisting of seamlessness, adoption date, number of integrated subsystems, system composition, number of functional areas linked and number of users. Topi, Lucas and Babaian (2005) asserted that a commonly expressed perception of ERP is that it is a very complex system to understand and use. This is displayed in the complex and difficult user interface and the complexity of SAP system features. Based on research by Klaus and Blanton (2010), the complexity issues experienced by many users are due to the ERP system consisting of multiple modules that are not as simple as an in-house system. Moreover, the functionality
and complexity in ERP systems can induce bewilderment, irritation with failure and other negative responses from users, which lead to mistakes while working on such applications, especially for the novice user (Ceaparu et al. 2004; Goodwin 1987). This is the type of user that needs to spend extra time and effort to develop a better understanding of the ERP system interface (Faisal, Faridi & Javed 2011).

Two reviews of previous literature reported a limited number of published studies on the usability problem of ERP systems (Matthews 2008; Topi, Lucas & Babaian 2005). Nielsen (1994) defines usability as a quality attribute that assesses how easy it is to use a user interface. Usability attributes are conditions that enhance system efficiency and functionality (Chang, S-I et al. 2011). A system with lower usability often generates complaints and dissatisfaction from users, who eventually give up on the system (Anandhan et al. 2006). In view of this, since system usability issues can militate against effective ERP system usage, it is recognised as one of the problem areas. Usability issues are exemplified in problems such as identification of and access to correct functionality, transaction execution, system output limitation, a need for manual procedures for addressing a lack of functionalities in the ERP system, reporting problems and learnability (Topi, Lucas & Babaian 2005). As argued by them, it is crucial to identify the factors affecting users’ ability to effectively use the system in order to improve the system design. Thus, the potential impact of enhancing usability such as a better understanding of system usage will save the organisation time and money by lesser training cost, faster ramp-up times and completion of assigned tasks (p. 89).

In addition, prior studies (Matthews 2008; Singh & Wesson 2009; Topi, Lucas & Babaian 2005) have also revealed that the ERP system suffers from various usability issues such as the complexity and tediousness of finding functionality and information, lack of guidance for users to ensure accurate task completion, lack of adaptability of the ERP system behaviour, poor user interface to support the user’s actions for task completion, inefficient retrieval of frequent data and poor information accessibility, the complex task of understanding the layouts of screens, difficult and tedious interpretation of output, and poor learnability and memorability of the different parts of the ERP system operations.
2.2.1.2 Data-related problems

The second category of ERP system usage problems concerns data-related problems (Deng & Chi 2012; Haug, Arlbjørn & Pedersen 2009; Lin, H-F 2010). The data problem originates from data quality. The business data of a company can be more or less useful, depending on the quality of the data. Poor data quality at the operational level increases operational costs because time and other resources are spent detecting and correcting errors (Redman 1996). Park and Kusiak (2005, p. 3962) defined ‘data quality’ as ‘the measure of the agreement between the data views presented by ERP and that same data in the real world’. Data quality (DQ) is fundamental to ERP operating processes since ERP facilitates decision making and inter-organisational cooperation (Batini et al. 2009), and poor data quality could result in an underperforming system or even total failure (Momoh, Roy & Shehab 2010). Moreover, multifarious data errors could easily be flowed throughout the system due to ERP’s automated and process-driven nature (Haug, Arlbjørn & Pedersen 2009; Xu et al. 2002).

In the IS literature, Ballou and Pazer (1985) divided data quality into four dimensions: accuracy, timeliness, completeness and consistency. They concluded that the data accuracy dimension is the easiest to evaluate, since this is merely the difference between the correct value and what was actually used. Similarly, this evaluation is also applicable to the timeliness dimension. The emphasis of the completeness dimension evaluation is on whether data are complete or not, rather than what percentage is complete. According to Ballou & Pazer (1985), this evaluation is also pretty straightforward. The harder part is to evaluate the consistency dimension as it requires two or more representation schemes in order to be able to make a comparison (Ballou & Pazer 1985).

Prior studies in ERP system literature have also illustrated the system usage problems pertaining to data problems (Deng & Chi 2012; Haug, Arlbjørn & Pedersen 2009; Xu et al. 2002). Deng and Chi (2012) performed a longitudinal analysis of system usage problems in the business intelligence context, which proposed that data problems signify problems that occur during a user’s employment of a SAP/BW report, such as problems with data inquiry, data retrieval, missing data, incomplete data, incorrect data, duplicate data, inaccessible data and non-applicable data. They provided examples of data problems such as users questioning an unrecognised transaction amount and another user doubting an amount stated in the report.
According to Xu et al. (2002), although an ERP system could possibly resolve some of the data quality problems by providing organisations with useful information in a timely manner, this also becomes a disadvantage of the system. This is because the occurrence of inaccurate, incomplete, inconsistent, inaccessible or doubtful data can negatively impact on any operation because of the ERP being widely deployed throughout the organisation. Since ERP system modules are intricately linked to one another, inaccurate data input into one module adversely affects the functioning of other modules. For example, when inaccurate data are entered into SAP that leads to inaccurate results caused by the integrated, automated, process-driven nature of ERP data flow. Thus, it can intensify DQ issues through compounding minor errors of data that flow through the system (Haug, Arlbjørn & Pedersen 2009; Xu et al. 2002). Moreover, correcting data errors after ERP system implementation obviously leads to increased operational costs and thus lowers effectiveness and limits the competitive edge in that it can undermine strategic initiatives and responsiveness to customers (Xu et al. 2002).

Certain causal relationships among data quality dimensions have been identified through case studies in organisations (Strong et al. 2007). For example, Strong et al. (1997) argued that when there are multiple data sources for the same data, inconsistency between these sources can cause low believability in the data, which can further lead to the perception of low-value-added data, and data not being used in the end.

### 2.2.1.3 Infrastructure-Related Problems

The third category of ERP usage problems focuses on infrastructure-related issues related to network infrastructure scalability, inadequate hardware requirements and performance problems with the ERP system with respect to underlying IT infrastructures (Markus et al. 2000; Soja & Paliwoda-Pekosz 2009). An IT infrastructure problem also refers to technical issues that are associated with the particular system solutions and surrounding IT infrastructure (O’Leary 2000). According to Huang and Palvia (2001), infrastructure, including both basic and IT infrastructure, constitutes the basic prerequisite for ERP implementation. ERP cuts across several functions, including the internal operations of the company and transactions with its suppliers, customers, banks and others. The soundness of the entire infrastructure is necessary to facilitate the complete value chain management enabled by ERP.
2.2.1.4 Interface-Related Problems

Users interact with systems and computers via user interfaces. Hence, an interface should be able to support a successful interaction between user and computer. The main objective of user interface design is to make the user's interaction as effective as possible. In a review in a prior study, it was suggested that interface-related problems could be one of the problems affecting ERP system usage problems experienced by the end users (see Table 2.1) (Arasanmi, Wang & Singh 2013; Singh & Wesson 2009). Arasanmi, Wang and Singh (2013) proposed navigation guides as indicators of a good interface design to enable end users to explore the capabilities of the system. A system interface facilitates information seeking and exploration of a system's features. Therefore, a user-friendly interface increases ERP usage efficacy. Consequently, these researchers added good interface design to minimise the problem of limited system use. Their finding is aligned with other studies that have suggested that an easy-to-use interface increases system usability (Choi, Kim & Kim 2007; Lim, Lee & Nam 2007).

In a study conducted by Koh, Gunasekaran and Cooper (2009), they highlighted the tremendous impact of the system interface, which is one component of system design, on users' perceptions of the ease of use of a technology. Aransami, Wang and Singh (2013) argued that system design is a key reason for ERP utilisation. According to them, it is essential to have a user-friendly and easy-to-navigate interface when using the various modules of a complex software application like ERP. This is because a complicated interface is likely to increase users' frustration and anxiety, and make them hesitate to use the skills they have learned, and therefore would contribute to various ERP usage problems. There was a similar finding by Osei-Bryson, Dong and Ngwenyama (2008), whose study revealed a positive relationship between ERP design features and perceived ease of use and perceived usefulness. Hence, when encountering difficult interfaces of an ERP system, users will be less willing to put up with the system and will search for alternatives when centralised IS development fails to meet user needs (Eason 1988).

In the study conducted by Singh and Wesson (2009), they postulated that complexity of ERP system interfaces negatively impacted on the usability of the system. Further, they urged a need to improve the overall usability of ERP systems by improving interface design. This could be achieved by use of a consistent set of usability criteria that are specific to ERP systems.
According to Singh and Wesson, these extrapolated usability criteria can be divided into six categories, which indicate that the usability of an ERP system is dependent on:

1. **Performance and stability of the ERP system** (system reliability and system responsiveness)
2. **Navigation capabilities of the ERP system** (navigation and guidance)
3. **Degree of learnability of the ERP system** (learnability, memorability and ease of use)
4. **Ability of the ERP system to provide effective task support** (task support, perceived usefulness, and accuracy and completeness)
5. **Presentation capabilities of the ERP system** (UI presentation and output presentation)
6. **Ability of the ERP system to be customised to a particular organisation and an individual user** (customisation and flexibility).

This section illustrates the end user problems with an ERP system that encompass system, data, infrastructure and interface-related problems. These problems are shaped by various antecedent factors. The next section presents a review of previous studies concerning the influencing factors that impede ERP system use by end users. The review is structured according to four types of classification: organisation, user, technology and task. In addition, a brief review of the related theories and the methodologies adopted is also presented.

### 2.3 FACTORS INFLUENCING ERP SYSTEM USAGE

During the post-implementation phase, several factors are critical for shaping the emergence of ERP system usage problems in organisations. The factors identified from the previous studies could be categorised under four broad areas: organisation, user, technology, and task (Behrens 2009; Behrens & Sedera 2004; Elbertsen, Benders & Nijsen 2006; Houghton & Kerr 2006; Kallinikos 2004; Rikhardsson & Kraeemeergard 2006; Soja & Paliwoda-Pekosz 2009). Table 2.2 presents a summary of the influencing factors that affect ERP system usage. While some researchers have provided empirical evidence (Behrens & Sedera 2004; Jones et al. 2004; Strong, Volkof & Elmes 2001), others have only provided the ideas conceptually (Houghton & Kerr 2006; Kerr, Houghton & Burgess 2007).
### Table 2.2: A Summary of Literature of Influencing Factors that Affect ERP System Usage

<table>
<thead>
<tr>
<th>Reference</th>
<th>Research Method</th>
<th>Theory/ Framework</th>
<th>Domain of Literature</th>
<th>ORGANISATION</th>
<th>USER</th>
<th>TECHNOLOGY</th>
<th>TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan, Zhang &amp; Yen (2013)</td>
<td>Literature Review</td>
<td>Internal Control</td>
<td>ERP</td>
<td></td>
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<td>X</td>
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## Table 2.2: A Summary of Literature of Influencing Factors that Affect ERP System Usage (continued)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Research Method</th>
<th>Theory/ Framework</th>
<th>Domain of Literature</th>
<th>ORGANISATION</th>
<th>USER</th>
<th>TECHNOLOGY</th>
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<td></td>
<td></td>
<td></td>
<td>Training</td>
<td>Technical</td>
<td>Control</td>
<td>Knowledge</td>
<td>Computer Self</td>
</tr>
<tr>
<td>Sedera &amp; Dey (2013)</td>
<td>Self-reported measures observer assessment</td>
<td>SE and user competence</td>
<td>ERP</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sun &amp; Bhattacherjee (2011)</td>
<td>Survey</td>
<td>UTAUT</td>
<td>IS</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>Shih (2006)</td>
<td>Survey</td>
<td>TAM and CSE</td>
<td>ERP</td>
<td>X</td>
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<tr>
<td>Shih &amp; Huang (2009)</td>
<td>Survey</td>
<td>TAM and CSE</td>
<td>ERP</td>
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<tr>
<td>Usher &amp; Olfman (2009)</td>
<td>Case Study</td>
<td>IT Gov Maturity Model</td>
<td>ERP</td>
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</table>
2.3.1 Organisational Factors That Affect ERP Usage

With regard to organisation, prior studies have identified training, technical support, control and top management as factors affecting ERP system usage (Behrens & Sedera 2004; Houghton & Kerr 2006; Kerr, Houghton & Burgess 2007; Soja & Paliwoda-Pekosz 2009).

First, inadequate training has been cited by a number of researchers. For example, Soja and Paliwoda-Pekosz (2009) claimed that an inappropriate schedule of training, inadequately trained users and lack of support from IT experts influenced ERP system usage. User training relates to the extent to which organisational managers provide formal IT training and education to employees to facilitate their usage of an ERP system (Sun & Bhattacherjee 2011, p. 473). Prior studies have indicated that training influences individual system usage either directly (Gallivan, Spitler & Koufaris 2005) or indirectly, by shaping users’ attitudes and beliefs such as perceived usefulness and perceived ease of use (Agarwal & Prasad 2000).

Others have suggested that the drivers behind the push to use alternative systems to replace an ERP system were poor training or ineffective training methods (Houghton & Kerr 2006; Kerr, Houghton & Burgess 2007). Their studies were in agreement with other studies that reported inadequate training as crucial inhibitors in functionality, not only in the implementation phase but also in the usage phase of the ERP system (Yu 2005). According to Yu (2005), although education is a cornerstone of ERP implementation, the emphasis is usually only on user training and courses are centred on computer/system operation rather than on understanding the ERP concept and spirit. This view was shared by Chang et al. (2008), who revealed training as a facilitating condition that encourages employees to use the ERP system.

The need for employee training was also illustrated in the case study of Maguire, Ojiako and Said (2010), where half of the employees felt that the ERP system was quite difficult to use due to the lack of training. Maguire, Ojiako and Said (2010) also attributed the difficulty of use to working with a limited number of expert users. An ERP system is usually frequently upgraded and improved during the post-implementation phase. Therefore, to ensure that staff can use any newly installed function effectively, continuing training must be provided. However, in this study, it was commonly reported that employees were unable to get adequate training due to lack of funds, resources and expert trainers (Maguire, Ojiako & Said 2010).
Previous studies have also suggested that lack of training is closely related to the lack of technical support. In the earlier research conducted by Markus et al. (2000), they identified lack of training as one of the key elements that intensified ERP system problems during the testing and implementation phases. Insufficient training may produce mistakes in data entry, which are costly in ERP environments. Markus et al. argued that inadequate training during the early phase leads to problems in later phases. In their study, due to inadequate training, end users did not understand how to cancel erroneous transactions. Thus, the organisation began to shift their reliance to ‘key users’ or IT personnel to perform the routine tasks that were supposed to be carried out by the end users. Due to the demands of their tasks, the key users were unable to allocate time to conduct better training for the end users. Meanwhile, the IT personnel did not have time to solve the ERP usage problems and to continue the upgrading process. This leads to the second organisation factor, technical support.

Second, technical support refers to the availability of specialised personnel such as help desk and information centre to answer users’ questions regarding IT usage, to troubleshoot emergent problems during usage and to provide instructions and/or hands-on support to users before and during usage (Bhattacharjee & Hikmet 2008). Technical support, according to Igbaria et al. (1997), pertains to: (1) technical assistance, such as on-site and off-site services from the IT department, (2) technical consulting channels, such as consultant services from the system vendor and co-workers and (3) technical instruction, such as tutorials, training courses, lectures or seminars, system manuals and technical textbooks (Igbaria et al. 1997).

As technical and skills guidance becomes more comprehensive, IS users can gain a deeper understanding of the system and thereby increase their usage of system features. In dealing with usage issues such as system error, data error and operational error, the problems can be dealt with efficiently by providing technical consultation and guidance in a timely manner, which in turn boosts the extent of system usage (Chang, K-C, Lie & Fan 2010). In IS literature, Staples and Seddon (2004) reported that technical support is positively related to individual IT usage in a mandatory usage situation. Sun and Bhattacharjee (2011) proposed that adequate levels of technical support can enhance users’ perceptions of control over their IT usage and thereby enhance their IT usage. Their study demonstrated that technical support is indeed effective in indirectly shaping organisational users’ IT utilisation behaviour by influencing users’ perceptions related to IT usage behaviour.
In the ERP system context, technical support from either an internal or external IT expert has been highlighted by prior studies as an influencing factor that affects ERP system usage (Behrens & Sedera 2004; Ko, Kirsch & King 2005; Soja & Paliwoda-Pekosz 2009). Behrens and Sedera (2004) stated that support signifies the encouragement, either formal or informal, given to the development and maintenance of the shadow system. They classified technical support into two types: internal and external support. Internal support denotes support available within the host organisational unit and external support relates to support for the system outside the host organisational unit.

Given that ERP systems are complex packages with a level of functional interoperability far greater than what is found in most stand-alone IT systems, organisations tend to rely on external expertise for help not only in developing and implementing but also in maintaining such systems (Ko, Kirsch & King 2005; Markus & Tanis 2000). The same is true at later stages (post-implementation) for organisations where the effectiveness of the adopted systems is being assessed (Sedera et al. 2003; Amoako-Gyampah 2007).

By stepping into the post-implementation stage of the ERP deployment, the organisation will experience conflicts among ERP stakeholders. Prior studies have suggested that the organisation can remedy this deficiency by seeking support from ERP consultants, ERP vendors, or trading partners (Gable 2003, Zhang et.al 2005). Hence, the role of external expertise and consultants as mediators during the post-implementation stage should not be underestimated. This is due to the fact that when an organisation sets out to adopt a new system, it usually faces a learning burden, framed by Thong, Yap and Raman (1996) as the *barrier knowledge*. Therefore, external sources of technical expertise are crucial in helping organisations to bridge the knowledge gap (Wang, ETG et al. 2008).

External expertise is responsible for transferring their knowledge on the effective use of the ERP system to the focal organisation (Gable 2003). Gable (2003) further suggested that a good external expert or consultants are vital reservoirs of codified and uncodified ERP knowledge accumulated through a series of prior implementation experience, which is valuable for configuring and applying the ERP system at both the operational and managerial levels. Gable (2003) added that external expertise can provide professional advice and accordingly help the focal organisation successfully realise both managerial and operational benefits.
In addition, Zhang et al. (2005) urged that the ERP vendors can also contribute to the post-implementation success by providing continuous post implementation assistance. An ERP system is not just a software package; rather, it represents a vendor’s total solution to business that certainly extends into the post-implementation stage. Amongst post-implementation assistance includes emergency maintenance, system updates, and so on. All of these can keep the ERP system running efficiently and sustain the source to generate benefits.

In summation, the role of ERP external expertise can contribute to the post-implementation success by providing continuing post-implementation assistance. An ERP system is not just a software package; rather, it represents a vendor’s total solution to business that certainly extends into the post-implementation stage. Post-implementation assistance includes emergency maintenance, system updates and so on. All these can keep the ERP system running efficiently and sustain the source to generate benefits (Zhang et al. 2005). Hence, usage problem faced by the end users of an ERP system are more likely to surface if there is a lack of technical support provided either internally or externally.

The third influencing factor of ERP system usage is control. Control is constituted by the control behaviour of all the people involved in planning and scheduling activities – in one way or another, formally or informally (Wäfler et al. 2011). With regard to IT control, COSO (Committee of Sponsoring Organisations of the Treadway Commission) has created a COSO framework that divides IT controls into two types: general control and application control (Ramos 2004). General control includes data centre operations (e.g., job scheduling, backup and recovery), systems software controls (e.g., acquisition and implementation of systems), access security, and application system development and maintenance controls. Application control is designed to control data processing; ensure the integrity of transactions, authorisation, and validity; and encompass how different applications interface and exchange (Ramos 2004).

General control and application control complement each other. This is because general control also supports application control by allowing the information system to be smoothly operated (Flowerday & von Solms 2005). For instance, when financial reporting is based on information systems such as ERP systems, IT controls help organisation to achieve the objective of internal control. Thus, via information security, IT controls are able to manage and protect information and information systems from unauthorised access, use, disclosure, disruption, modification or destruction.
An increasing number of firms depend on ERP to address operational transactions. Transactions involving information systems require particular control standards and criteria because IT utilisation presents difficulties in inspecting the audit trails of business operations (Fan, Zhang & Yen 2013). Therefore, information system security must be emphasised, especially in financial transactions (Vance et al. 2012; Wallace, Lin & Cefaratti 2011). Walters (2007) stated that many information system threats, such as unauthorised access and system vulnerability attacks, influence the accuracy and reliability of financial data derived from information systems.

In the ERP system context, van de Riet, Janssen and de Gruijter (1998) noted a number of security aspects associated with the system; these aspects include security policy, user authentication, authorisation, time restriction, log and trace, and database security. However, Behrens and Sedera (2004) argued that control deals with the perceived control of users of their individual work. They classified control as a user or people factor rather than an organisation-related factor. The conceptualisation of control in their context differs slightly from the present research context. Behrens and Sedera (2004) postulated control as the antecedent factor that influences the development of a 'shadow system'. They argued that after the implementation of an ERP system, end users felt they were no longer in control of many aspects of the business process. This would stimulate the use of alternative systems. However, in the present study, lack of organisational control is treated as an antecedent to ERP system problems.

Fan, Zhang and Yen (2013) suggested that it is management and auditors who are responsible for identifying the necessary control-related considerations of an ERP system. This is because, in this digital age, the absence of information security in a certain company implies that the entire company is built on a fragile foundation such that it could not survive related internal control tests (American Institute of Certified Public Accountants (AICPA) 1983). Information systems, especially in an ERP environment, require many internal controls owing to the pervasive implementation of IT and the need to minimise problems.
2.3.2 User Factors That Affect ERP Usage

User factors have been recognised as one of the elements that might impede the usage of an ERP system. Rikhardsson and Kraemmergaard (2006), for example, argued that after ‘going live’, the greater challenge was not to get software and hardware to work properly, but to change employees’ behaviour and attitudes. This period is characterised by user insecurity, changes and frustration due to errors in the system set-up as well as unfamiliarity with the new system, and these are reflected in the users’ dissatisfaction with the system and the probable underuse of the ERP system.

In the review of prior studies, two main user factors were identified: embrace of knowledge and CSE. Both will be described with regard to their influencing roles on ERP system use. It is noted that while some studies use the term ‘user factor’ (Ko, Kirsch & King 2005; Sedera & Dey 2013; Soja & Paliwoda-Pekosz 2009), other use the term ‘people factor’ (Behrens & Sedera 2004). Both labels are treated here as the one category of ‘user factor’.

First, knowledge was identified as influencing ERP system usage. Germain & Ruiz (2009) described knowledge as an integral aspect of expertise. In the knowledge management stream of literature in the IS discipline too, there is a strong recommendation for end-user knowledge for system success (Bingi, Sharma & Godla 1999; Davenport 1998). According to Kerr, Houghton and Burgess (2007), although employees are aware of the advantages offered by the ERP system with respect to integrated IT resources, better decision making and better access to data, this awareness is not reflected in practice. The employment of alternative systems in order to cope with an ERP system's shortcomings appears to be due to the user's mistrust of the ERP. Furthermore, organisations that have an adequate pool of IT knowledge tend to have more favourable outcomes than those lacking in such resources, not only during the implementation stage (Ko, Kirsch & King 2005), but also in later stages where the effectiveness of the adopted system is assessed (Amoako-Gyampah 2007; Sedera, Gable & Chan 2003). Such internal IT skills and knowledge can form a solid foundation upon which more specific knowledge related to ERP packages can be built (Scheer & Habermann 2000).

Knowledge is also associated with individual absorptive capacity. ‘Absorptive capacity’ means ‘the ability of a recipient to recognise the importance and value of externally sourced knowledge, assimilate it and apply it’ (Ko, Kirsch & King 2005). Ko, Kirsch & King (2005) demonstrated that
individual users’ absorptive capacity plays a significant role in knowledge transfer from ERP consultants to members of the recipient organisation. They argued that official training is not sufficient to have all the ERP users become familiar enough with ERP systems to use them effectively.

In the ERP systems context, Park, Suh & Yang (2007) suggested that a user’s absorptive capacity for understanding external knowledge is the user’s acquired knowledge regarding ERP systems. They added that a user’s capacity for assimilating knowledge is the user’s ability to internalise new knowledge into his or her task environment. Once organisational members understand new knowledge, they need to assimilate it. This can be affected by how comfortable the user feels when executing the tasks using the technology. Additionally, the absorptive capacity is ‘strongly related to the members’ prior knowledge based on the subject matter’ (Kim 1998). Therefore, when organisation members possess greater relevant prior knowledge, they absorb new knowledge more effectively (Park, Suh & Yang 2007). For instance, end users who have a basic understanding of computers/IT have an advantage in taking in new knowledge related to ERP and ultimately find such systems relatively easy to use or learn (Amoako-Gyampah 2007).

In addition to knowledge, the ability and effort by individuals to handle particular situations depend on the strength of their belief in their own effectiveness. Thus, another concept that has been cited as one of the influencing factors for ERP system usage is self-efficacy. The self-efficacy concept, which was introduced by Bandura & Prusak (1989), refers to ‘people’s judgments of their capabilities to organise and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has, but with judgments of what one can do with whatever skills one possesses’ (p.391). According to Sedera and Dey (2013), whose multi-method study was designed to conceptualise User Expertise in Contemporary Information Systems, the concept of self-efficacy offered by Bandura is context specific, the valuing of self in specifically defined situations. The definition of self-efficacy provided by Bandura (1977) highlights the importance of distinguishing between component skills and the ability to perform actions.

Further studies by Bandura discussed the psychological construct of self-efficacy as a concept that refers to ‘beliefs in one’s capabilities to mobilise the motivation, cognitive resources and courses of action needed to meet situational demands’ (Wood & Bandura 1989, p. 506). In
In general, the self-efficacy construct proposed by Wood and Bandura (1989) reflects a person’s perceived skills and ability, including motivations and the ability to adapt to the work environment. Gist (1987) suggested that self-efficacy is expected to influence task effort, persistence, expressed interest and the level of goal difficulty selected for performance. Hassan (2006) argued that the definition of self-efficacy does not refer to the assessment of actual skills that people possess but to the evaluation of what people believe they can accomplish.

Consequently, different types of self-efficacy emerged from Bandura’s (1977) original work, one of which is computer self-efficacy (CSE) (Compeau & Higgins 1995). ‘Computer self-efficacy' denotes an individual’s judgement of their computer skills. Compeau and Higgins (1995) defined CSE as the judgment of an individual regarding their ability to use a computer. Computer self-efficacy is a significant factor in the use of systems and even in helping people more easily acquire many of the skills associated with effective computer use (Shih & Huang 2009). Individuals with high efficacy expectations are more likely to succeed in a given task (Oliver & Shapiro 1993).

Lack of CSE influences ERP system usage either directly or indirectly. For example, Shih and Huang (2009) found that top management support plays an important role in ERP implementation. Top management support strongly, directly and positively affects computer self-efficacy, perceived usefulness and perceived ease of use. Meanwhile, computer self-efficacy to some extent directly affects perceived usefulness and perceived ease of use. In another example, Kwahk and Ahn (2010) postulated that technical knowledge, which is usually acquired through education and training, is likely to be acquired more effectively and efficiently when user self-efficacy for using a computer and IT is high. They found that this is in contrast to the effect of the lack of computer self-efficacy, when the user is reluctant to use a computer or IT. Thus, they concluded that computer self-efficacy can influence successful IS adoption by positively influencing individual expectancies about job performance when using specific IS to perform tasks. This scenario is heightened in the ERP system environment, where computer self-efficacy plays a more critical role due to the higher technological complexity of ERP systems than other IT-based system (Bueno & Salmeron 2008).

In line with this, the utilisation of the computer self-efficacy construct is relevant in the present research context to explain the antecedent factors to ERP system usage issues. Thus, further discussion on how this concept is applied is presented in Chapter 3.
2.3.3 Technology Factors That Affect ERP Usage

The review of previous studies continues with a discussion of technology factors. ‘Technology factors’ refers to tools and techniques (not necessarily IT) available to people in order to do their work (Behrens & Sedera 2004, p. 1714). A number of studies have identified technology factors such as technology attributes (Behrens & Sedera 2004; Kallinikos 2004) and technology affordance (Behrens & Sedera 2004) that might affect ERP system use.

First, **technology attributes** covers a range of factors such as lack of integration into the technical environment, complexity in extracting data from ERP (Houghton & Kerr 2006), the fragmentation nature of the ERP system (Kallinikos 2004) and functionality, infrastructure, affordance, reliability and the development paradigm (Behrens & Sedera 2004).

According to Behrens and Sedera (2004), the use of an alternative system instead of ERP may signal the inappropriateness of the technology or technical practices. These technology factors include functionality, infrastructure, reliability and the development paradigm (Behrens & Sedera 2004, p. 1720). They propose: (1) **Functionality** relates to how well the technology matches the functions it was designed to perform. (2) **Infrastructure** includes the human, information and technical resources used to support the ERP system and, in particular, the underlying architecture and design base of the technology. (3) **Reliability** is the ability of a given system to consistently produce the same results, preferably meeting or exceeding its specifications. (4) The **development paradigm** is the software have process model used for development. Houghton and Kerr (2004) reported that lack of integration into the technical environment also influences ERP system usage, leading to the development of an alternative system to cope with ERP usage issues. In addition, Kallinikos (2004) suggested that the fragmentation nature of the ERP system could influence ERP system usage issues.

The second technology factor is **affordance**. According to Behrens and Sedera (2004), this technology factor refers to the functions and operations of the technology (ERP) (p.1720). Affordance also represents users’ and designers’ perceptions of whether some action is possible or not with the technology (Norman 1988, p. 9). For example, it means technology can make an action difficult or easy depending on the experience, knowledge or culture of the person using it. Therefore, it is said that the notion of technology affordance can create opportunities and constraints which are inherent in the composition of its user (Norman 1988).
In this research context, affordance is implied in the functions and operations which are provided by the SAP system. While ERP (SAP) systems are often criticised for being complex and hard to use, previous studies (Choi, Kim & Kim 2007; Sodnik et al. 2008) have suggested that improving ERP usability with better and more consistent design, affordance, integrated search functionality and friendly interfaces will make SAP easier to use.

Boudreau and Robey (2005) suggested that affordance is the result of the intertwining of IT and organisational features. Hence, affordance needs to be recognised not only as a technological object that has some recognised functionality, but also as a social object. With respect to the latter, the influence of a social object on organisational functioning and performance cannot be separated from expertise, jobs, processes or structures.

In conclusion, this category of technology was the least cited in the literature. Therefore, an exploratory study was carried out to explore what other factors belong to the technology category.

2.3.4 Task Factors That Affect ERP Usage

A task factor is a process of turning input into output (Goodhue & Thompson 1995). A task factor that could influence ERP system usage identified from the literature is task interdependence (Strong, D, Volkoff & Elmes 2001). The definition of task interdependence used by previous research was mainly derived from IS literature. For example, the early definition by McCann and Ferry (1979) suggested task interdependence as the degree to which sub-units must exchange information or material in order to complete their tasks. Based on the definition by Goodhue and Thompson (1995), task interdependence suggests an exchange of output between segments within a sub-unit and/or with other organisational units. On the other hand, drawing from the field of psychology, Campion, Medsker and Higgs (1993, p. 827) defined task interdependence as the degree to which members interact and depend on one another to accomplish their task/work. In the ERP system context, based on the definition by Campion, Medsker and Higgs (1993), task interdependence implies the degree to which individuals interact and depend upon others to accomplish their work via an ERP system.
Goodhua and Thompson (1995) proposed task interdependence as one task characteristic of the Task-Technology Fit theory (TTF). The review of prior studies (Goodhue & Thompson 1995; Norzaidi et al. 2007) indicates that few studies have investigated the link between task interdependence and TTF. Goodhua and Thompson (1995) found that users who engage in a task that is interdependent with another organisational unit would need to identify, access, and integrate data from a variety of systems. In addition to that, Norzaidi et al. (2007) conducted a survey on various organisations in the port industry in Malaysia which suggested that if more interdependent tasks are assigned to the port managers, that could eventually reduce their intranet usage. According to them, this is because some information is not available from the intranet, leading to less task fit and thus causing delay in accomplishing the task.

In the general IS literature, early studies showed that the average communication frequency increases with the level of task dependence and uncertainty (Adler 1995; Loch & Terwiesch 1998). Therefore, the greater the degree of task interdependence, the greater the coordinative and innovative information requirements (Meyer 1991). More to point is that users who are task-interdependent on others should be motivated to use collaborative (networked) technology more than those who act alone (Goodhue & Thompson 1995). In another example, Strong, Volkoff and Elmes (2001) postulated task interdependence as the task factor that might affect ERP system usage. In the highly integrated ERP environment, the system requires organisations to have well structured processes, data and roles; however, lack of task interdependence signals a lower degree and nature of interaction among groups required for the completion of a task. Hence, the users’ responses could include working around ERP (Strong Volkoff & Elmes 2001).

Task interdependence has also been studied in the area of knowledge management systems (KMS) by Lin & Huang (2008). The goal of their study was to understand the antecedents and their relationships to KMS usage by examining task, IT and individual cognitive factors. They extended TTF with SCT to investigate the factors influencing KMS usage and this indicated that KMS usage is influenced by task interdependence, perceived task-technology fit, KMS self-efficacy and personal outcome expectations. The results from their study showed that task interdependence is positively related to KMS usage.

Despite the number of studies on task interdependence, most of them were not drawn from generic IS and KM fields, except for the study by Strong Volkoff & Elmes (2001). However, the understanding of how this factor influences ERP usage problems during the post-
implementation phase is still limited. Thus, similar to the technology factor, an exploratory study was carried out to explore what other factors belong to the task category that might influence ERP system usage problems. The detailed explanation of the exploratory study is described in Chapter 3.

2.3.5 Summary of Literature on Antecedent Factors

As presented in Table 2.2, the review of previous studies suggested that the common methodology employed in capturing the antecedent factors to ERP system usage was qualitative research (Behrens & Sedera 2004; Bendoly & Cotteleer 2008; Houghton & Kerr 2006; Kerr, Houghton & Burgess 2007; Soja & Paliwoda-Pekosz 2009; Usher & Olfman 2009).

As depicted in Table 2.2, although a diversity of theories was used, yet there was no coherent explanation of the antecedent factors which could influence ERP system usage. A number of researchers conceptualised the factors by using a grounded theory approach (Behrens & Sedera 2004; Kerr, Houghton & Burgess 2007; Soja & Paliwoda-Pekosz 2009). From the perspective of system usage, the definition offered by Burton-Jones and Straub (2006) encapsulated the three major elements: user, system and task. Therefore, in this research context, the theory used to explain antecedent factors that lead to ERP system usage is drawn from TTF theory and Gap Framework because constructs from both theories cover organisation, user, technology and task factors. Hence, these two theoretical approaches fit the present research context. The justification for these two theoretical frameworks is described in detail in Chapter 3.

Research on computer self efficacy and user competence also provides a useful theoretical background to this study. For decades organisations have tried to identify the important elements that affect users’ competence. The most likely factors seem to be organisational, task, individual and technological. A better understanding of the end user computing process will enable managers to develop effective strategies for improving individual skill and usage levels. The employment of CSE to inform the antecedent factors domain is described in section 3.3 on the development of the initial conceptual framework.
The next section continues the review of previous literature pertaining to strategies employed by end users in dealing with ERP usage issue.

2.4. REVIEW OF LITERATURE ON END USERS’ STRATEGIES IN COPING WITH ERP USE PROBLEMS

Since there is limited research on coping mechanisms for ERP use problems, this section reviews the IS, ERP and organisational change (because implementing ERP constitutes a major change) literature to gain insights into problem coping concepts and mechanisms. When facing problems, end users might not necessarily rely on the main system (ERP) sanctioned by their organisation and might rather impose some other strategies to deal with the usage issues (Beaudry & Pinsonneault 2005; Benamati & Lederer 2001; Magni, Provera & Proserpio 2010; Monteiro, Jarulaitis & Hepso 2012). From the ERP system perspective, the strategies used are known as ‘coping mechanisms’ (Bendoly & Cottelee 2008; Urus, Molla & Teoh 2011b).

The word ‘coping’, based on Lazarus and Folkman’s definition, is ‘constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person’ (Lazarus & Folkman 1984, p. 141). Further, they added that coping is ‘an effort to manage’ a situation and hence differs from its outcome and that coping is different from ‘mastery’ (p. 142). In other words, a coping mechanism refers to the adaptation acts by an individual in response to disruptive events and changed circumstances in the working environment (Beaudry & Pinsonneault 2005).

The review of the IS, ERP and organisational change literature showed that coping mechanisms can be grouped into two categories. The first type is the ‘problem-focused’ and the second type is the ‘emotion-focused’ (Lazarus & Folkman 1984). The first form, problem-focused coping, aims at problem solving by changing environmental pressures, barriers or resources, or by changing oneself (e.g., learning new skills or procedures). Three types could be grouped in problem-focused coping: (1) Improvisation (Monteiro, Jarulaitis & Hepso 2012; McGann & Lyytinen 2010; Magni et al. 2010; Gasser 1986), (2) Adaptation (Beaudry & Pinsonneault 2005) and (3) Circumvention (Bendoly & Cotteler 2008). The second type of coping, emotion-focused coping, aims at reducing or managing negative emotional distress. It does not change the situation itself, but changes one’s perception of the situation (p. 150). There are two types of
emotion-focused coping: (1) **Endure** (Benamati & Lederer, 2001; Feng, Benamati & Lederer 2011) and (2) **Ignore/ Disregard** (Benamati & Lederer, 2001).

Table 2.3 provides a summary of strategies employed by end users. The next section describes the individual concepts used for end users' practices and strategies to cope with ERP system usage problems.

**Table 2.3: Summary of Strategies in Coping with ERP System Usage Problems**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Domain</th>
<th>Problem focus</th>
<th>Emotion Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaudry &amp; Pinsonneault, (2005)</td>
<td>IT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Benamati &amp; Lederer (2001)</td>
<td>IT</td>
<td>X X</td>
<td></td>
</tr>
<tr>
<td>Benamati, Lederer &amp; Singh (1997)</td>
<td>IT</td>
<td>X X</td>
<td></td>
</tr>
<tr>
<td>Benbasat &amp; Barki (2007)</td>
<td>ERP</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bendoly &amp; Coteleer (2008)</td>
<td>ERP</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bingi, Sharma &amp; Godla (1999)</td>
<td>ERP</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Elie-Dit-Cosaque &amp; Straub (2011)</td>
<td>IS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Fang, Benamati &amp; Lederer (2011)</td>
<td>IT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferneley &amp; Sobrepererez (2006)</td>
<td>IS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Gasser (1986)</td>
<td>ICT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Magni Provera &amp; Proserpio (2010)</td>
<td>IS Dev</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>McGann &amp; Lyytinen (2010)</td>
<td>IS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Monteiro, Jarulatis &amp; Hepso (2012)</td>
<td>IS</td>
<td>X</td>
<td></td>
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<tr>
<td>Orlikowski (1996)</td>
<td>IS</td>
<td>X</td>
<td></td>
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<tr>
<td>Tyre &amp; Orlikowski (1996)</td>
<td>IS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Urus, Molla &amp; Teoh (2011b)</td>
<td>ERP</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
2.4.1 Improvisation (Problem-Focused Strategy)

Improvisation is viewed as one of the strategies practised by an ERP system's end users when facing some difficulties in using the system. Improvisation is defined as a form of intuition which guides action in a spontaneous way (Crossan & Sorrenti 1997) or as ‘the conception of action as it unfolds – acting without the benefit of elaborate prior planning’ (Kamoche & Pina e Cunha 2001, p. 735). Furthermore, Moorman and Miner (1998, p. 699) suggested improvisation as ‘the degree to which composition and execution converge in time’. Individual improvisation, according to Magni, Provera and Proserpio (2010, p. 246), refers to ‘a creative and spontaneous process of trying to achieve an emergent need in a new way’. The latter aspect of improvisation is often referred to as the ‘bricolage’ component, which relies on the creative process in which individuals engage in an attempt to find a new solution from the recombination of available resources in a short time frame (Ciborra 1999; Magni, Provera & Proserpio 2010).

The improvisation strategy is essential to overcome the ‘misfit’ issues of existing ERP systems. The misfit between delivered functionality and need functionality is described as the gap between the processes the ERP system supports and the working processes of the organisation (Ciborra 1999). Swan, Newell and Robertson (1999) argued that the gap in interests between customer organisations which desire unique business solutions and ERP vendors is the root of the high failure rate of ERP implementation. In unpredictable environments, smart reflexive and improvisional skills would be necessary since this sort of reactionary outcome fills the unavoidable gaps between formal procedures/standards and emergent events (Ciborra 1999).

These misfits could be related to data format, operating procedures and output, which force companies to make package and organisation adaptations during the pre- and post-implementation phases. Prior studies have indicated that there is no ERP implementation success without resolving those misfits first (Hong & Kim 2002; Soh, Kien & Tay-Yap 2000). Furthermore, an organisation can lose its competitive advantage by adopting an ERP system that does not fit its business strategy (Davenport 1998).

Hence, the improvisation strategy is triggered in response to the above scenario, when information cannot be properly processed through existing IT functionality or process design of encountered IS events (Johansson 2009). As a result, improvisation of IS has emerged to cope with the constraints arising from the disruptive events of system implementation and use, and
organisational change. During the initial improvisation stage, a user creates a solution for a new requirement by producing an IT or process workaround, or a configured improvisation according to the business characteristic (McGann & Lyytinen 2010).

In the study conducted by McGann and Lyytinen (2010), the two dimensions of improvisation strategies performed by users were: (1) nature of improvisation and (2) target of improvisation. The first classification is also known as ‘configurable Improvisations’, which occur when new requirements can be met with the designed system tailorability, in contrast to ‘workarounds’, which occur when the system fails to satisfy the current user requirements with the designed functionality. The latter (target improvisation) consists of ‘an adjustment of a process vs those that are an adjustment of the IT’ (McGann & Lyytinen 2010, p. 6). Within these dimensions, they proposed four classification schemes as outlined below (pp. 6–7):

1. **Configured Process Improvisation**: A dynamic modification of an information system use process facilitated by existing system functionality. This promotes agile responses to changing system requirements by rapidly developing new use processes. For example, changing the order entry process by changing task sequence or user responsibilities.

2. **Configured IT Improvisation**: A dynamic modification of IT that is facilitated by existing system design functionality. This promotes agile responses by re-configuring the IT system to meet the new requirements. For example, using filtering options to configure what is displayed on reports and showing only certain parts.

3. **IT Workaround**: An adjustment in the use of an IT, which involves intentionally using it in ways it was not designed for. For example, downloading data into an Excel spreadsheet to perform calculations and analysis that the primary system cannot do.

4. **Process Workaround**: The creation of temporary organisational processes in response to an unmet IT requirement by changing the process ‘on the fly’. For example, planners mailing schedules to suppliers because they are unable to access them due to a system problem.
Recent work on improvisation in the ERP system context was carried out by Monteiro, Jarulaitis and Hepso (2012). Drawing on a longitudinal (2007–2011) case of ambulatory maintenance work in the oil and gas sector, they analysed the relationship between technologically mediated work practices specifically in terms of how similarity in work practices is achieved. They proposed that reaching absolutely similar (or ‘best’) practices is unattainable. Thus, they postulated the importance of flexibly stepping up the degree of formalism and the amount of resources in response to number, frequency and type of anomaly. Rather than a fixed, institutional response, a dynamically modulated response relative to the gravity of the anomalies is required. In view of this, rather than having a rigid formal procedure to deal with usage problems, an organisation must be ready to make improvements by increasing the amount of resources, particularly by investing additional funds or resources to customise ERP system functionalities to meet users’ requirements.

To sum up, in every instance of use, users exercise considerable discretion in their appropriation of the technology with local workarounds and situational improvisations. Thus, the role of improvisation is to support and minimise the problems or constraints in official system like ERP. Users may use such practices or strategies to cope and handle the limitations that are required for their needs with either intentional or unintentional behaviour. This is because many problems emerge only after a technology has been in use for a period of time (Mørch 1995), and when organisations try to rush the introduction process, they fail to identify and correct the problems that later hamper productive use of the technology (Tyre & Orlikowski 1994).

### 2.4.2 Adaptation (Problem-Focused Strategy)

In addition to improvisation, ERP system users may also use different routes in handling system use. Another identified strategy is ‘adaptation’, which is defined as ‘modifications brought to the technology, working procedures, and users’ beliefs’ (Tyre & Orlikowski 1996, p. 791). Adaptation has been recognised as a strategy employed in managing the gap between the changes and practices of an ERP system. This gap is derived from misalignments (poor fits) between the technology and (a) technical requirements, (b) the system through which the technology is delivered to users or (c) user organisation performance criteria (Leonard-Barton 1988). The poor fit problem, in turn, requires adaptation of the technologies already in use (Hong & Kim 2002; Volkoff 1999). Additionally, the adaptation process is indispensable because
a technology almost never fits perfectly into the user environment (Beaudry & Pinsonneault 2005).

Therefore, employees must constantly adapt to new applications, functionalities and workflows (Tyre & Orlikowski 1994) that could occur in the periods of pre-implementation, implementation and post-implementation (Ragu-Nathan et al. 2008). For instance, users adapt to accommodate the misfits of a technology and when a workaround is not readily available, users might change their goals to something that they know the system can do (Leonard-Barton 1988). With ERP adaptation in place, it increases the feature-function fit between ERP and the adopting organisation, which is likely to result in lower resistance, reduced training needs and less organisational adaptation (Bingi, Sharma & Godla 1999). User adaptation is the cognitive and behavioural efforts exerted by users to manage specific consequences associated with a significant IT event that occurs in their working environment (Carroll 2004). The adaptation process is highly iterative and continually evolves as a function of the ongoing changes that occur in the user or environment relationship (Beaudry & Pinsonneault 2005).

One thing lacking in the prior IT adaptation research, either in general IS literature (Beaudry & Pinsonneault 2005; Ferneley & Sobreperez 2006) or the ERP literature context (Bingi, Sharma & Godla 1999), was a failure to integrate the IT adaptation concept with system usage. However, there are now influential advocates for different approaches to how users react to IT and the ERP system (Benbasat & Barki 2007; Elie-Dit-Cosaque & Straub 2011). For instance, Benbasat and Barki (2007) have specifically recommended that researchers improve the conceptualisation of system usage by including user adaptation in conceptualisations. This issue has also been also addressed by Burton-Jones and Straub (2006).

According to Benbasat and Barki (2007), system use perspective ‘should be broadened from one that exclusively focuses on a narrow “amount” view of users’ direct interaction with systems to one that also includes users’ adaptation, learning, and reinvention behaviours around a system’ (p. 215). They argued that a richer model of system use should also take into account a broader range of behaviour instead of focusing only on the direct relationships between usage behaviour and its antecedents. User strategies of adaptation mediate the relations between usage behaviour and its antecedents. Additionally, Elie-Dit-Cosaque and Straub (2011) urged for the need to open ‘the black box’ of system usage. They presented new measures for the Coping Model of User Adaptation in the context of disruptive IT. Their study has enhanced the
understanding of systems usage by showing user adaptation behaviour as a form of mediation, and has contributed to system usage research by developing new measures for Coping Mechanism User Adaptation.

### 2.4.3 Circumvent (Problem-Focused Strategy)

Another category of problem-focused strategies that could be employed by end users to overcome an ERP usage problem is by circumventing the problem (Bendoly & Cotteler 2008; Urus, Molla & Teoh 2011b). Bendoly and Cotteler (2008) studied how organisations and employees react to rule structures embedded in the system. They suggested that managers and users may have strong intentions to circumvent systems in the presence of a perceived task-technology misfit. They argued that despite the presence of constraining protocols, individuals may opt for a variety of alternatives to complete their tasks. They believed that these alternatives, coupled with differences in individual characteristics, would represent a natural source of observable process variation in organisations. Hence, although certain rule structures may limit alternatives in the short term, in the long run there is a tendency for individuals to attempt to circumvent rule structures, especially in the presence of factors such as perceived misfit and ease of circumvention. In the study conducted by Urus, Molla and Teoh (2011b), the ‘circumvent’ concept was employed to describe how end users cope with ERP system issues by using a strategy that deviates from the officially sanctioned ERP system.

### 2.4.4 Endure (Emotion-Focused Strategy)

Endurance is considered one of the least effective coping mechanisms used to deal with usage problems of an IT system. ‘Endure’ is described by Benamati and Lederer (2001, p. 40) as ‘endure problems rather than actively try to reduce them or ignoring or working around problems’ (Fang, Benamati & Lederer 2011). According to Fang, Benamati and Lederer (2011), ‘endure’ also includes learning new IT without formal education. Learning new IT without formal education may be deemed less rational and constructive than doing so with instructors, classes, and integrated texts and exercises because this type of coping mechanism does not require organisational support.
Endurance was considered by previous studies as one of the frequently used strategies adopted by end users when dealing with changes in information technology (Benamati, Lederer & Singh 1997; Benamati & Lederer 2001). According to Benamati and Lederer (2001), ‘endure’ could include situations where users try to solve a problem without depending on the organisational resources and work around a problem without fixing it.

2.4.5 Inaction/Ignore Problem (Emotion-Focused Strategy)

Inaction or Ignore Problem relates to the absence of any specific action by end users while dealing with ERP system issues. This practice suggests that end users who encounter ERP systems usage issues ignore problems rather than trying to minimise them. Although this strategy, like endure, is commonly adopted by end users, it usually does not produce constructive results (Benamati & Lederer 2001, p. 40). Hence, this strategy is argued not be considered as a coping mechanism because it cannot be envisaged as an effective means of dealing with IT problems.

According to Benamati and Lederer (2001), inaction appears to be the course taken in the presence of insufficient resources or perhaps in the absence of severe problems. The frequency of inaction also indicates how end users or organisations often deal with their problems. Benamati and Lederer (2001) further elaborated that the use of inaction as a coping mechanism may imply that the organisation or end user is trying to cut the cost of solving a problem by changing the IT system.

Except for the two groups of coping strategies (problem-focused and emotion-focused) discussed above, most of the coping mechanisms were drawn from the legacy IS field rather than the ERP literature. Coping strategies to overcome ERP usage problems are still an under-explored research area. Little is known about how end users cope with ERP usage issues, particularly during the post-implementation phase. Therefore, an exploratory study was carried out to determine any other ways users cope with ERP problems. The findings from the exploratory study pertaining to the other types of coping mechanisms are presented in Chapter 3. The findings are also used as the groundwork in the formulation of the Initial conceptual framework that is discussed in Chapter 3.
2.5 SUMMARY OF THE CHAPTER

This chapter has reviewed previous studies in order to identify the key areas of the literature pertinent to ERP system usage issues, factors affecting ERP system usage and strategies for coping with ERP problems, particularly during the post-implementation phase.

The first section highlighted usage problems during the post-implementation phase of ERP system. In doing so, the study has drawn from both IS and ERP system literature. The existing literature proposes that ERP usage problems encompass four major areas: system, data, infrastructure and interface-related problems. However, the literature review also suggests that there is no coherent concept used for explaining ERP use problems. Additionally, previous studies are unable to offer a clear classification of usage problems by end users. Therefore, an exploratory study was carried out to explore end users’ experiences with ERP system issues to gain insight for a better classification of the problems.

In the second section, a review of prior studies was done to discover the factors that might affect ERP system usage problems. The review of previous studies was mainly based on ERP system literature. Several influencing factors were identified and structured under organisation, people, technology and task. Finally, in the third section, this chapter discussed the strategies employed by end users in dealing with ERP system issues. It was discovered that the five main strategies employed in dealing with usage issues comprise: improvisation, adaptation, circumvent, endure and inaction/ignore problem.

Most of the identified influencing factors and strategies to cope with usage issues were drawn from the generic IS literature. This was particularly the case in the review of the coping mechanisms domain. However, in all the relevant fields, there was a paucity of literature that explicitly and systematically classified the factors and integrated the three areas of problems, antecedent factors and coping mechanisms. Noting this gap, an exploratory study was carried out to examine other ERP usage problem and coping mechanisms during the post-implementation phase. A detailed description of the exploratory study is provided in Chapter 3. Also in Chapter 3, the findings are presented from the exploratory study that became the basis for the formulation of the initial framework, and the development of the initial conceptual model is explained.
Chapter 3

CONCEPTUAL FRAMEWORK

3.1 INTRODUCTION

This chapter presents the initial conceptual framework based on the findings of the literature review reported in Chapter 2 and an exploratory study. The chapter is organised into four sections. Section 3.2 describes the exploratory study, derived from face-to-face interviews and surveys conducted to assist in the development of the initial conceptual framework. Section 3.3 details the development of the initial conceptual framework. In this section, the development of constructs derived from either the two theoretical frameworks – the Task-Technology Fit (TTF) and the Gap Framework – or the exploratory study findings are presented. This chapter concludes with a summary in Section 3.4.

3.2 THE EXPLORATORY STUDY

ERP systems are evolving into a strategically central area for most organisations nowadays. Thus, to obtain the optimal advantages offered by this highly integrated system, organisations need to minimise if not eliminate issues pertaining to system usage. Unsolved problems in an ERP system make it difficult for users to adapt to the system functionalities in performing tasks, and hinder the continuing and extended use of the system (Ceaparu et al. 2004; Deng & Chi 2012). When ERP system usage problems are understood, actions can be taken to resolve the problems in a timely manner, which enables organisations to take advantage of the benefits offered by ERP. Despite the importance of ERP issues that hinder effective system usage, this is still an under-researched phenomenon.

Previous studies are of the same mind that when a system does not accommodate legitimate organisation needs, users employ coping strategies to overcome some of the flaws in the system (Beaudry & Pinsonneault 2005; Bendoly & Cottelee 2008; Oreg 2003). The identified coping strategies include improvisation (Monteiro, Jarulaitis & Hepsø 2012) and ignore or disregard the problems (Benamati & Lederer 2001). See Chapter 2, Literature...
Review, for a detailed discussion. Although some coping strategies have been identified, it is a relatively under-explored research area, especially in regard to integrating coping mechanisms with post-implementation ERP system usage problems.

Because of the two gaps mentioned above, it was crucial to conduct an exploratory study to get a better understanding of end users’ experiences with an ERP system and to inform the initial conceptual framework development for this thesis. This process is consistent with the soft-positivist stance of the researcher (see Chapter 4) and Yin’s (1994, p.80) recommendation to use an exploratory study to obtain adequate insight into the basic issues being investigated.

3.2.1 Aims and Objectives of the Exploratory Study

The main objective of the exploratory study was to gain insight into the extent of users' experiences in using an ERP system to ensure that the research design was informed by both prevailing theories and a fresh set of empirical evidence, as suggested by Yin (1994). More importantly, the lessons learnt from the exploratory study were indispensable for informing the development of the initial conceptual framework. The objectives of the exploratory study were two-fold:

1. To explore users' experiences with issues and difficulties they encountered while using an ERP system and to identify factors that inhibit ERP system usage.

2. To explore users' experiences in coping with ERP system issues.

3.2.2 Research Method

Due to the aim of the exploratory study, which is to examine the extent of users' experiences in using ERP system and how they find ways to cope with problems, it was crucial to select an appropriate research method. A case study approach was used because a study based on interviews with key informants is commonly an acceptable method for the early stage of research (Yin 1994). This is also aligned with the approach of (Stuart et al. 2002, p. 422), where in the discovery stage, when conceptual development is in its formative stage, the case researcher explores concepts in the real world by looking for patterns that are insightful.
and interesting, and offer the possibility of providing predictive, explanatory power and understanding.

The primary data collection methods were semi-structured interviews and an exploratory survey. The case selected for the exploratory study was one of the subsidiaries of a leading oil and gas organisation in Malaysia, identified henceforth as Case A. The selection criteria for the case were that the company had implemented an ERP system for more than three years, which gives sufficient maturity to explore end users’ experiences of system usage (Nolan & Nolan 2000; Gargeya & Brady 2005). According to Nolan & Nolan Institute (2000), the notion of different stages of ERP implementation into its level of maturity could be grouped into three classifications: (i) beginning; the organisation had implemented ERP (SAP) in the past 12 months (ii) consolidating; organisation had implemented ERP (SAP) between 1 to 3 years (iii) maturity; organisation had implemented ERP (SAP) for more than three years. Besides, the company agreed to participate in the study, as accessibility is a critical issue in a case study research design.

The selected Case A, is one of the subsidiaries of PATRON BERHAD (a pseudonym) that was incorporated on 23 July 1997. Case A is based at the PATRON Petroleum Industry Complex (PPIC) in Kerteh, Terengganu. Terengganu is one of the 13 states in Malaysia, located on the eastern coast of Peninsular Malaysia. Case A is well known as the main producer of ammonia and syngas in the Asian region. With 196 staff, Case A’s major products are ammonia, carbon monoxide and Oxogas. With regard to ERP systems, Case A uses SAP (Systems Application and Products in Data Processing). Four SAP core modules are used: Financial Information and Controlling (FI & CO) module, Material Management module (Triple M), Plant and Maintenance module and Human Resource Integrated System module (HRIS).

Permission to access the company for data collection purposes was first obtained from the manager of HRMA, who became the gatekeeper for liaising with the managers of various departments. Although the HRMA Manager provided initial access to the exploratory study, she was not involved in the interview sessions. That was because during the data collection period, she had already moved to headquarters (PATRON BHD). Her place was taken over by an Executive of HRMA, who at the same time was also acting as the HRMA manager for Case A.
Four departments were involved in the exploratory study: Finance and Planning, Engineering and Services, Supply Chain Management, and Operating Performance and Improvement (see Table 3.1). Qualitative data were collected by using face-to-face interviews with nine participants from the four departments. These nine participants were selected by purposive sampling (Cavanaugh, Delahaye & Sekaran 2001). Purposive sampling is suitable because members must conform to certain criteria; in this context, the interviewees must have had experience in working with the ERP system. The managers of the four departments both participated in the interviews and helped in the recruitment of personnel to be interviewed from their respective departments. The Plain Language Statement (PLS) (Appendix 3.5 6) and Consent Form (Appendix 3.4) were used in recruitment.

The data were collected for two weeks from 2 July to 15 July 2009. From a total number of 9 interviews, two were conducted in Bahasa Malaysia (Malay Language). They were an Executive and a Buyer from the Supply Chain Management Department of Case A. This is due to the fact that both interviewees felt more comfortable using their ‘mother-tongue’ language. In order to ensure that the meanings of the interview protocol and interview transcripts were not compromised, the transcripts for both interviews were first translated from Malay into English. The process was crucial to facilitate the analysis process as well as to provide consistency in data transcription. To ensure validity, a third party verified the translation of interviews from Bahasa Malaysia to English. In doing so, the researcher had sought assistance from her friend, who is an English Lecturer in her university. The interviews varied in length from 30 minutes to an hour and were conducted by using interview guides (Appendices 3.1 and 3.2). All interviews were recorded and transcribed prior to data analysis. The interviewees’ profiles are summarised in Table 3.1.

**Table 3.1: List of Exploratory Study Interview Participants**

<table>
<thead>
<tr>
<th>Department</th>
<th>Participants</th>
<th>Participant Codes</th>
<th>Dates</th>
<th>Years of ERP Usage Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance and Planning</td>
<td>- Manager</td>
<td>Mp1, Ep2</td>
<td>09/07/2009 - 13/07/2009</td>
<td>11 years - 8 years</td>
</tr>
<tr>
<td></td>
<td>- Executive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering and Services</td>
<td>- Senior Manager</td>
<td>Mp3, Ep4, Ep5</td>
<td>08/07/2009 - 07/07/2009</td>
<td>11 years - 9 years - 5 year</td>
</tr>
<tr>
<td></td>
<td>- Executive 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Executive 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain Management</td>
<td>- Senior Manager</td>
<td>Mp6, Ep7, Bp8</td>
<td>05/07/2009 - 06/07/2009</td>
<td>10 years - 9 years - 3 years</td>
</tr>
<tr>
<td></td>
<td>- Executive</td>
<td>Ep9</td>
<td>14/07/2009</td>
<td>4 years</td>
</tr>
<tr>
<td></td>
<td>- Buyer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Performance and Improvement</td>
<td>- Executive</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In addition to the interviews, an exploratory, paper-based descriptive survey was also conducted. The objective of the exploratory survey was for the researcher to become more familiar with the topic. There was no model in exploratory research due to the need to understand the concepts of interest (Kerlinger 1986). Exploratory and descriptive surveys are very helpful in identifying the concepts and the basis for measurement, and are appropriate for the early stages of research (Malhotra & Grover 1998). The survey was intended to gather data about end users’ experiences with SAP from the broad overview of the phenomena. A total of 100 participants were invited using a purposive sampling method (Cavana, Delahaye & Sekaran 2001). Of these, 70 accepted. The participants were interviewed by the investigator in their respective departments. A package containing the survey questionnaire (Appendix 3.3) and the Plain Language Statement (Appendix 3.6) was given to the respondents during the field study. The completed survey forms were collected by the investigator at the end of her visit to the organisation.

Of the total survey respondents of 70, over 50% held middle level managerial roles (e.g., senior manager, manager and executive); 19% were first level managers (administrator and supervisor), while the remaining 31% were clerical staff and others. In terms of longevity of SAP usage, the majority of the respondents had been using the system for less than five years, which accounted for 74%, 17% of them had been using SAP for between six and ten years, with only 9% who were considered experienced users who had used SAP for more than ten years. While 36% of respondents had been working for between six and ten years; 27% had been working for between three and five years; 21% had less than three years of working experience; and 16% had been in service for more than ten years.

The next section presents discussions of the interview findings and surveys in accordance with the two objectives of the exploratory study.

3.2.3 Users’ Experiences in Using ERP System

From the 21 survey questions, 11 were associated with users’ experiences with SAP. Three questions were asked on data issues (Q1, Q6, Q7), three questions were on SAP functionalities (Q11, Q12, Q15), four questions were related to the impact of the ERP system (Q16, Q17 and Q18) and one question was associated with ERP system benefits (Q8). (See Appendix 3.3 for the exploratory survey questionnaires.)
For the interviews, there were two different set of questions: manager and end user. For the first set (manager), a total of 18 questions were asked. While the first four questions related to the demographic profile, the remaining 16 questions were on problems that a manager faces with ERP and how they handle usage problems. Two questions specifically related to usage problems: Q5 and Q18(a). Five questions were on coping mechanisms and the rest of the questions were general questions pertaining to control, customisation and upgrading (see Appendix 3.1). The second set of interview protocol for the end user consisted of 12 questions. Two questions were on the user’s background (Q1 and Q2), four questions were asked on their experience with the technology used in the company (Q3, Q4, Q5 and Q6) and two questions were on their SAP experience (Q7 and Q8). One question was asked specifically on problems encountered by the participants (Q9) and the remaining three questions were on coping mechanisms (see Appendix 3.2 for details).

The results of the exploratory survey suggested several benefits from SAP system use in Case A. The majority of survey participants perceived that SAP provides control over their work (79%). Most of the participants also agreed that data pulled out of SAP is accurate and reliable (69%). In addition, the SAP system enabled users to speed up task processing time (70%). SAP was also viewed as an integrated system that manages to support the business processes of the respective departments (80%).

These findings are aligned with prior studies on ERP system benefits that include improvement in the accuracy and speed of transaction processing (Davenport, TH, Harris & Cantrell 2004), accurate financial reports (Colmenare'sc 2009; Velcu 2007) and business process improvements (Peng, DX, Schroeder & Shah 2008). Despite the system’s advantages, it is interesting to note that 53% of the participants believed that the employment of the SAP system has not completely eliminated the use or development of departmental or end-user specific systems. This indicates their reliance on alternative systems to deal with the limitations of the formally sanctioned system (ERP).

Further analysis of the nine interviews and exploratory survey revealed that users encountered system, data and interface issues. The exploratory study produced results which corroborated the synthesis of the previous studies in which ERP usage problems were classified into system, data and interface-related problems (see Table 2.1). Table 3.2 illustrates a summary of the SAP (ERP) usage problems and a sample of the Interview logs.
Table 3.2: SAP Use Problems and Issues of Exploratory Study

<table>
<thead>
<tr>
<th>Category</th>
<th>Dimension/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Functionality</td>
<td><strong>Unavailability</strong> Lack of SAP functionality to perform a required task in a timely way (based on ISO EC 9126)</td>
<td>It is quite difficult to locate some reports directly from SAP system. For example, I require the customised report related to brand name and the damage cost from the maintenance cost report, but I could not get it from SAP. Similarly, if I just wanted to know the top ten maintenance bad actor, but it gives me headaches to go through all irrelevant report from SAP. [Engineering and Services Senior Manager]</td>
<td>7</td>
</tr>
<tr>
<td>System Usability</td>
<td><strong>Underutilisation</strong> SAP features have not been fully exploited by SAP users (Jaspersen, Carter &amp; Zmud 2005)</td>
<td>We have not fully explored some of the functionalities that reside in SAP. We have invested a lot for this system, yet, I feel that we are not taking advantages out of it. I would say that we may only utilise less than 60% of the overall system functionalities. [Supply Chain Management Senior Manager - Mp6]</td>
<td>5</td>
</tr>
<tr>
<td>Incompleteness of Data</td>
<td><strong>Omission</strong> of or missing data entered into SAP (Based on Ballou &amp; Pazer 1985)</td>
<td>The data that I gathered from SAP sometimes is not complete. For instance, I need to retrieve total of Purchase Order for the month, but the required data is not there. When I run some of the reports, the detail order description is not captured. Later when I print another report that has the order description, it does not have the delivery detail. So I need to run several report code and combine them….. It is a waste of time. [Buyer Supply Chain Management - Bp8]</td>
<td>2</td>
</tr>
<tr>
<td>Interface</td>
<td><strong>SAP's screen</strong> has not been designed in an attractive way for SAP users</td>
<td>The problem of the present SAP system layout is the inability to simplify the steps, retrieving and evaluating certain information that we want. If we want to get certain things, we have to go through few and longer steps. This is sometimes quite tedious, but if we have a simplified and favourite button like at the ATM bank, you can just click the favourite icon and the item will appear automatically. [Operating Performance and Improvement Executive - Ep9]</td>
<td>5</td>
</tr>
</tbody>
</table>

**Unavailability** of essential SAP functions was cited as one of the major SAP problem areas. This problem is particularly prevalent in regard to the reporting and analysis functions of SAP. A number of interviewees stated that because of SAP's limited reporting layout and functionality, they pull out the information from SAP and generate reports through Microsoft Excel or Microsoft Project. To quote from a Manager of the Supply Chain Management department:
Chapter 3: Initial Conceptual Framework

The data is already available from SAP, yet in terms of reporting, it was not able to cater the graphical presentation of report layout that was required by the management team. [Senior Manager Supply Chain Management - Mp6]

Moreover, the findings demonstrated a typical problem of locating and generating customised reports:

It is quite difficult to locate some reports directly from SAP system. For example, I require the customised report related to brand name and the damage cost from the maintenance cost report, but SAP would not generate the detail report. Similarly, if I just wanted to know the top ten maintenance bad actor, but it gives me headaches to go through all irrelevant report from SAP.

[Engineering and Services Senior Manager - Mp3]

The survey findings strengthened the interview results, where more than half of those surveyed (59%) agreed that SAP is not effective in generating customised reports for management. Therefore, the majority of respondents (80%) regularly pull data out of SAP and transform it into Microsoft Excel format for report generation, and about two-thirds of the respondents (67%) use an Access database or Excel spreadsheet to overcome SAP limitations. Despite that, 67% of those who responded felt SAP is an effective system in providing a method for manipulating data relevant to their job requirements. More than half (59%) of the survey respondents believed that SAP is not effective in generating customised report for management. Further, only 56% believed that SAP provides information and functionalities that meet the needs of the department, and about two-thirds of the respondents (67%) used an Access database or Excel spreadsheet to overcome SAP limitations.

For example, the absence of tracing capabilities from the inventory management function resulted in the use of an alternative system, known as TREMA. This system was created by PATRON BHD for the purpose of setting up the inventory parameters and deciding how much inventory should be kept in one particular period. This is the sanctioned system created internally and thus it was not considered a feral information system.

Some of our required functionalities are not available [in SAP]. We do face some problems concerning our Inventory Management. Say for the material A, we need to know the consumption detail based on its movement…. the amount involved and the consumption date, how much we need to purchase for further usage… So, we observe the consumption pattern of the material for 5 years and propose the required
amount of stock needed for setting the appropriate inventory parameter. Unfortunately, at this stage, this function is not yet available in SAP.

[Supply Chain Management Executive - Ep7]

SAP is indeed a very powerful system, yet end users have not really optimised it due to various reasons such as the lack of customised functionalities. In order to use SAP functionalities, it should be customised to users’ requirements. However, due to the cost constraint in Case A, some of the customised functionalities were not made available to SAP users. An executive from the Operating Performance and Improvement department (Ep9) opined:

Although the modules in SAP are there, you still need to customise the function to suit with our needs. On the other hand, when we talk about customisation, no doubt it involves additional costs. As we are aware that to implement the SAP system alone is really costly, by adding the customisation, it will definitely incur an additional cost. These are apart from the ID cost. At present, the cost for user ID is AUD1330 (RM4000) per year, at present we have 210 staff and everyone needs to have the ID, and so can you imagine how much cost is involved? Of course, if we wanted to use more SAP features, the additional cost would incur.

[Operating Performance and Improvement Executive - Ep9]

In terms of system underutilisation, some of the SAP system functionalities are not fully exploited. For example, the executive from the Finance and Planning Department highlighted, ‘We are not familiar with many SAP features and this restricts us from utilising the system…. one more thing, we have to eliminate the island system in order to utilise SAP.’ [Ep2]

To illustrate this issue further, a manager from the Supply Chain Management Department (Mp6) suggested that the utilisation rate of the SAP system is less than 60% (see Table 3.2). In another example, a system underutilisation problem was highlighted by a senior manager of the Engineering and Services Department (Mp3): ‘From my observation, we have invested a lot for SAP but our users are not really utilising it. I could say the utilisation rate could be around 50% to 60%’.

Another SAP usage problem revealed in Case A is the SAP interface. The interface problems include poor screen display, navigation and access to information, and poor system output. Some of the participants pointed out the considerable amount of effort needed to navigate a simple transaction. This is especially felt by novice users. An executive
from the Engineering and Service Department described his own experience: ‘Knowing the transaction code is essential to execute any transactions...because it would take us several routes just to get to our desired screen....this is what I have experienced before.' (Ep4).

An executive from the Finance and Planning Department also agreed by commenting that:

I have to spend quite some time to familiarise myself with the full functionality of the interface. The interface was so unexciting to use and not that user friendly too.

[Finance and Planning Executive - Ep2]

In addition, interface problems are also manifested in difficulty in interpreting and understanding SAP system output. This problem was reported by a number of respondents. To cite an example from an executive of the Engineering and Services Department:

I have experienced difficulty especially during my early days as an SAP user. I hardly understand the report from SAP; it does not have a lot of flexibility. It does not give me the information that I need...furthermore, it makes my work more difficult.

[Engineering and Services Executive - Ep5]

The analysis also showed that although surveyed users believe that SAP is effective for accessing (73.%) and processing (67%) data, a couple of SAP users suffered data incompleteness problems and were unable to generate customised monthly Purchase Order Reports. This was because the information required by the users (description, delivery detail) needs to be retrieved from separate SAP report codes. The combined data are then transferred to Excel to cater for the users’ needs. This is consistent with the survey response where 69% of respondents believed that the data they pull out of SAP is always accurate and reliable. However, a small number of those surveyed rely heavily on manual records that they have created themselves (34%) or have been created by others (23%) outside the SAP environment.

3.2.4 Users’ Experiences in Coping with ERP System Issues

In addition to the ERP end user usage problems, the exploratory study also attempted to discover the coping mechanisms employed by end users in dealing with ERP system shortcomings. The review of previous studies revealed how users would find ways to deal with information system problems. Among the identified coping mechanisms were improvisation (Monteiro, Jarulaitis & Hepsø 2012), ignore or disregard the problem (Benamati & Lederer 2001) and abandonment (discontinue using ERP). However, since
ERP is a mandatory system (see, eg. Bagchi, Kanungo & Dasgupta 2003; Brown & Lockett 2004), end users do not have the option of discontinuing using the system or switching to a new system (DeLone & McLean 1992). Thus, an exploratory study was carried out to explore the other coping mechanisms employed by end users.

The findings of end users’ experiences in coping with SAP (ERP) system issues were derived from both survey and interviews results. In the survey, 11 questions were asked pertaining to alternative software or systems employed by respondents in order to overcome any shortcomings of the ERP system. These questions were Q2, Q3, Q4, Q5, Q9, Q10, Q13, Q14, Q19, Q20 and Q21 (see Appendix 3.3). For the first interview protocol (manager), five questions pertained to coping mechanisms: Q6, Q7, Q8, Q10, Q18 (b) and (c) (see Appendix 3.1). For the second interview protocol (end user), three questions (inclusive sub-questions) were on coping mechanisms: Q10, Q11 and Q12 (see Appendix 3.2).

Results from the exploratory study revealed the widespread use of alternative systems by SAP users in Case A. One result was that 53% of those who were interviewed indicated that the implementation of the SAP system was unable to fully eliminate the used or creation of alternative systems, despite the fact that 61% of the total participants agreed that SAP system difficulties did not contribute to the employment of alternative systems. Additionally, Microsoft Excel and Access were frequently cited as major options to deal with the limitations of the formally sanctioned system (SAP). Further, more than two-thirds of the participants (71%) agreed that they rely heavily on e-mail and faxes rather than SAP functionalities to communicate workflows.

The interview and survey results from the exploratory study suggest the use of a ‘feral system’ as a major coping mechanism employed by end users in Case A. The ‘feral system’ comprises feral use of information technology and feral information systems. The following section discusses these mechanisms.
3.2.4.1 Feral Use of Information Technology

Feral use of information technology signifies the use of various standard software applications such as Microsoft Excel and Project or in-house databases to overcome some limitations of the formally sanctioned system (SAP). A number of instances of using Microsoft Excel to cope with the unavailability of ERP functions for the preparation of customised reports were found, as the standard reporting functionality of the ERP system (SAP in this case) was mentioned to be quite poor. Although sometimes some of the reports taken directly out of SAP give all the information that is needed, the layout and format are not in accordance with management needs. An executive from the Supply Chain Management Department highlighted:

To accommodate the [reporting needs of managers] … I download the data from the system, add the necessary details like Purchase Order with detail description and prepare the report in Excel. [Ep4]

Likewise, in the Finance and Planning Department, Microsoft Excel is used for costing and evaluation reporting. The senior manager of the Finance and Planning Department recaps:

For our costing, which again, we have a specific reason for not using SAP. This is because the similar function from SAP is expensive. However, the data created in Excel will be uploaded into the system. It is more on the system automation for the calculation of our costing. Somehow, all of the required formula is already there [Excel template], so we just plug in the new number and get our desired outcome. [Finance and Planning Senior Manager - Ep1]

In another example, Excel is used to bypass calculating deferred taxation using SAP and to revert back to old practices of manual calculations. An executive from the Finance and Planning Department explained:

We have some issues concerning the tax computation. When we do it, we have to do it correctly in the repair maintenance account codes. Say when we create the Purchase Order that requires us to fill up the tax detail, some of us tend to ignore it. The problem instigated when we generate the report from SAP as it is meaningless. [Finance and Planning Executive - Ep2]

The survey findings confirmed the interview results as 80% of survey respondents regularly pull out data from the SAP system and transfer them to Excel for the purpose of report generation. Nonetheless, only 31% regularly update the data kept in the Microsoft Excel files. When the participants were asked why they opt for Excel spreadsheets instead of configuring
the SAP system functions, more than two-thirds of the total respondents (67%) highlighted that the use of this alternative software was in order to overcome SAP system deficiencies. Working outside SAP with Excel suggests the possibility of a fictitious picture of the company inherited from changing the data. Thus, it leads to data quality issues that have been reported in the previous section (Section 3.2.3).

In addition to Excel, **Microsoft Project** is used to cope with the ERP problems end users encounter. One such instance is the use of Microsoft Project for planning, which was highlighted by an executive from the Engineering and Services Department. Since he is responsible for planning manpower for projects, he prefers Microsoft Project due to the graphical presentation functionality that it offers:

> By using this system [SAP], we manage to group the task according to its group or category. Yet, I require more general planning. So, through Microsoft Project, I am able to create schedule via the Gantt chart in order to estimate the completion task of each project.

[Engineering and Services Executive - Ep4]

Overall, although it was observed that users rely on the ERP system, results from the survey indicate that nearly half of the total respondents (46%) still depend on these standard software programs (Microsoft Excel, Project and Access) for better control of their work despite their duplication of some of the ERP system functionalities. Nevertheless, 74% of the respondents stressed that their department or work unit did not use a system which has similar functionalities to SAP. In addition to that, more than half of the respondents (56%) disagreed on the use of other systems to overcome SAP system deficiencies.

Besides Microsoft Project, another example of alternative mechanisms used in coping with the SAP system limitations is through the **Lotus databases**. According to an executive from the Supply Chain Management Department (Ep6), some of his staff was still relying on Lotus databases for data storage. He acknowledged that familiarity with the present Lotus database was the reason they were reluctant to shift to the integrated system (SAP): ‘They were already comfortable with Lotus database, as they have been using it for quite some time.’
3.2.4.2 Feral Information Systems

Apart from the use of feral information technology as discussed in the above section, a system known as Web Based Interface, developed by the other subsidiary of PATRON BHD, is used in Case A. This system is based on the Microsoft.NET application (Microsoft dot net application). It is designed to extract data from SAP and store this data (SAP) in the company’s network drive. Since there is a possibility that end users are unable to get their desired result from SAP, this system is employed as an alternative database. The introduction of this application is intended to support the SAP system in generating customised reports. The following quotes show how this application is used in Case A:

There is software which is developed in-house by one of our staffs in the other subsidiary of PATRON BERHAD in Kedah. He did some programming in Microsoft.NET application whereby we do not need to go through SAP any more…but then, the software [Web Based Interface] is just a medium to extract the data from SAP daily and stored in company’s network drive and everybody can just view from there.

[Engineering and Services Executive - Ep2]

A comment from another respondent corresponds with the above statement on the Web Based Interface: ‘As the SAP interface is not user friendly, there is a tendency that SAP end users are unable to get the desired report…That is why have an alternative for another interface….. we call it Web Based Interface.’ (Ep6)

3.2.5. Discussion of End Users’ Problems and Use of a Feral System as a Coping Mechanism

The end users’ problems refer to the ERP usage problems faced by end users during the post-implementation phase. It is apparent from the empirical evidence that end user problems are mainly associated with the unavailability of functionalities, the underutilisation of system functions and interface issues. The incompleteness of SAP data is the least cited problem by end users.

Unavailability of functions: Ideally, the ERP system should be able to provide functionalities that match end users’ task requirements, in terms of users’ understanding of what the functions offer and how they would assist them in performing their tasks (Faisal, Faridi & Javed 2011). However, one of the problematic ERP usage issue is the unavailability of some functionalities needed by end users. Since the ERP system was designed to meet
the needs of broad classes of businesses, rather than to specifically meet the particular needs of an individual business (Holsapple, Wang & Wu 2006), the unavailability of some of the functions users require is unavoidable. Thus, customisation of the ERP system is crucial to cater for the gap between users’ needs and what the system provides (Kanchymalay et al. 2013; Themistocleous, Zahir Irani & O’Keefe 2001).

**System underutilisation:** An individual user’s usage behaviour is critical in understanding the post-adoptive use of IS and maximising an organisation’s use of technology (Jasperson, Carter & Zmud 2005). The more useful and the easier it is to use a system to enable employees to accomplish their tasks, the more it will be used by end users (Kwahk 2013). Yet system underutilisation persists to slow down the ERP system usage as the underuse of system features may prevent organisations from fully realising the promised benefits of the installed IS (ERP) technologies (Davenport 1998; Rice & Cooper 2010).

**Interface** is one of the problems reported from the exploratory study. Interfaces are designed to aid users’ understanding of the system (Wang, C-H, Liao & Chu 2011). The ERP system’s complexity resides in the ‘unfriendly’ nature of the interface (Arasanmi, Wang & Singh 2013; Boudreau 2003; Scholtz et al. 2010; Yeh 2006) which results in poor usability (Scholtz et al. 2010; Singh & Wesson 2009). Thus, it is essential to have a user friendly and easy navigation interface since complicated interface designs are more likely to increase users’ frustration and anxiety in using the system (Arasanmi, Wang & Singh 2013). Poor interface design can lead to repeated data entry that is costly and time consuming and would inevitably lead to inefficiencies that affect the ability of an organisation to compete effectively in the marketplace (Trimi et al. 2005).

Previous studies have identified several ERP system problems, as described in Chapter 2, Literature Review. Yet there is no coherent theory and, further, there is no specific classification of ERP system usage problems. The initial classification presented in Chapter 2 is based on the present investigator’s own synthesis of the prior research conducted in the area. Hence, the exploratory study was carried out to fill this research gap and to further explore the potential ERP usage problems that may arise.

The analysis of the findings of the exploratory study also revealed that users rely on the use of standard software applications (such as Microsoft Excel, Project and Access, and other information systems) as one of their coping mechanisms, to work around the rigidity and limitations of the ERP system structures. The two main forms of this coping mechanism strategy discovered were Feral Use of Information Technology and Feral Information System.
The findings from the exploratory study and the review of prior literature are the basis for the formulation of the initial conceptual framework that is discussed in Section 3.3.

### 3.2.6. Implications of the Exploratory Study

The exploratory study was useful in providing some insight into users’ experiences pertaining to SAP problems and the coping mechanisms employed in dealing with the problems. The lessons learnt from the exploratory study had important implications for developing the initial conceptual framework that is discussed in detail in Section 3.3.

(1) The exploratory study provides empirical evidence that users experience some problems with system (unavailability of essential function), data and interface. In addition, it shows that the SAP system is underutilised. These findings lead to the formation of initial constructs for the End Users’ Problems domain of the conceptual framework, which becomes the basis for further investigation to establish other categories of problems that end users face in using ERP.

(2) To cope with system problems, users rely on standard software such as Microsoft Excel, Microsoft Project and Microsoft Access, which are considered important tools for patching flaws in the integrated system. The application of these standard programs as coping mechanisms can be seen under the ‘feral system’ concept. The feral system concept was introduced in prior studies (Houghton & Kerr 2006; Spierings, Kerr & Houghton 2012) to explain why a user or group of users develops an information system, uses information technology or inputs data to circumvent an organisational information system.

(3) Although the use of a feral system concept is likely to circumvent the functionality of a formally sanctioned system, in the present research, a feral system is intended to be a coping strategy, in line with studies that recognise that feral systems are used to deal with the drawbacks of ERP.

Based on the findings of the exploratory study and the literature review, the development of the initial conceptual framework is presented in the next section.
3.3 DEVELOPMENT OF INITIAL CONCEPTUAL FRAMEWORK

The research deals with three conceptual domains: end users' problems, antecedents of problems and coping mechanisms (see Figure 3.1) and follows the soft positivism point of view (Kirsch 2004). Similar to Kirsch’s (2004) study, this research is directed from a positivist view (Benbasat, Goldstein & Mead 1987; Yin 1994) that assumes the phenomena under investigation are relatively stable and exist objectively, as represented by an initial conceptual framework. Nonetheless, the investigator did not limit her boundary by examining the pre-existing construct alone. As the study evolved, she allowed for concepts to emerge through adopting an interpretivist approach to reveal new concepts and relationships (Klein & Myers 1999; Walsham 1993). One characteristic of a soft-positivist approach is the development of an initial conceptual framework to guide data collection and structure data analysis. To develop the conceptual foundation of the research, the investigator followed a theoretically eclectic approach (Garfield & Kurtz, 1977) by drawing relevant concepts from previous literature and theory in addition to the exploratory study.

Figure 3.1: Initial Conceptual Framework

- **Antecedent Factors Domain**: Organisation Control Resources
- **End Users' Problems Domain**: PROBLEMS - Unavailability of functions - System Underutilisation - Data Incompleteness - Interface
- **Coping Mechanisms Domain**: COPING MECHANISMS - Feral Information System - Feral Use of IT - Endure - Inaction/Ignore

- **User**
  - Magnitude
  - Individual Strength

- **Technology**
  - Affordance
  - System Reliability

- **Task**
  - Task Interdependence
  - Non-Routines

- **Task-Technology Fit**
Based on the ‘theoretically eclectic’ approach by Garfield & Kurtz (1977), those who identify themselves as eclectics do not follow any one theoretical orientation and tend to draw theoretical concepts from two or more theoretical viewpoints (pp.84). To develop the initial framework, pre-identified constructs of the end user problem domain were derived from the review of literature and the exploratory study. The initial framework is a framework and not a model in a confirmatory sense. For instance the antecedent factors to the problem were drawn from Task-Technology Fit (TTF), Gap Framework and Computer Self-Efficacy, while the review of literature and empirical evidence from the exploratory study became the basis for establishing the foundation of the coping mechanisms.

TTF was chosen because system usage basically involves a system, a task and a technology, and TTF and its extension with computer self-efficacy is one of the theoretical lenses that provide useful insights into how the characteristics of the technology, the user and the task might affect usage. Besides, the review of the literature in Chapter 2 indicated that the factors that influence end users’ problems in using ERP can fall into the four categories of organisation, user, task and technology; and TTF provides relevant concepts to theoretically anchor specific factors of the categories. Apart from that, TTF theory is relevant in the present research context because if the task of the end user does not match the technology (ERP system), it leads to task-technology-fit dimension.

The Gap Framework was chosen for the reason that this framework is a good fit with the present research context. The Gap Framework illustrates the relation between causal conditions (represented by people, business process, organisation and technology) and the emergence of a shadow system. Shadow system is defined as a system which replicates in full or in part data and/or functionality of the legitimate system in the organisation (Behrens & Sedera, 2004 pp. 1713). The Gap Framework moderated by intervening conditions such as resources and support. Therefore, this theoretical lens is very useful to explain causes of ERP system usage problems. On the basis of the Gap Framework, (a) the business process, organisation, resources and control factors of the Gap Framework can be used for anchoring the organisational antecedent factors, (b) the people involved can be used for user factors, and (c) the technology can be used to represent the technology-related antecedent factors.

The remaining discussion in this chapter focuses on the development of the conceptual foundation of these three domains.
3.3.1 First Domain: End Users’ Problems

The literature review (Section 2.2.1) identified system, information and data, and infrastructure-related problems as common ERP use problems (see Table 2.1). The exploratory study identified prevalent ERP usage issues as unavailability of function, underutilisation of system, incompleteness of data and interface problems. Based on these two sources, it seems that the most common challenges ERP users are likely to experience that impede system usage are: unavailability of functions, system underutilisation, data incompleteness and interface problems (see Figure 3.3). The definition of each construct is outlined in Table 3.3.

The analysis of the findings from the exploratory study suggested that the *unavailability of functions* required by end users is deemed to encumber ERP system usage. Hence, this factor is considered as one of the initial constructs representing the End User Problems domain (Figure 3.1).

Another usage issue revealed from the exploratory study was *system underutilisation*. This refers to system features that have not been fully exploited by SAP users. The primary reason for employees to exploit IS that they find the system to be useful for their tasks. However, despite impressive advances in ERP capabilities and functions, the troubling problems of underutilised systems were still visible, as evidenced in the exploratory study. In taking this result into consideration, system underutilisation is recognised as another initial construct used to explain ERP system usage as presented in Figure 3.1.

The reviews of previous studies have also recognised that data problems affect ERP system usage. However, data problems were found in the exploratory study to relate specifically to incompleteness of data. Based on this, *data problem (incompleteness)* was considered another construct applicable to explain end user ERP problems and form part of the initial development framework (see Figure 3.1).

In addition, *interface problems* indicate poor screen design and unfriendly interface design that significantly affect the usage of an ERP system by end users. This construct is used to explain the End User Problem domain (refer to Figure 3.1). The interface problem was selected based on a finding of the exploratory study as well as the literature review.
3.3.2 Second Domain: Antecedent Factors

The antecedent factors domain refers to the factors that lead to ERP system usage problems. Previous studies such as those of Houghton & Kerr (2006), Behrens & Seder (2004), Strong, Volkoff & Elmes (2001) and Compeau & Higgins (1995) have identified some antecedent factors to explain why ERP usage issues surface. The antecedent factors found are in four major categories: organisation, user, task and technology. To understand the relevant concepts representing these factors, the present thesis has adopted some constructs from the Gap Framework (Behrens & Seder 2004), the Task-Technology Fit theory (Goodhue & Thompson 1996) and computer self-efficacy concepts (Compeau & Higgins 1995).

3.3.2.1 The Task-Technology Fit Theory

The Task-Technology Fit (TTF) theory was developed by Goodhue & Thompson (1995) to provide a conceptual basis for user evaluation instruments. This theory is based on a task model of managerial decision making. The core of a TTF model, the Task-Technology Fit (TTF) construct, represents the ability of information technology (IT) to support a task (Goodhue & Thompson 1995). Task-Technology Fit theory, as defined by Goodhue & Thompson (1995, p. 216), is: the degree to which an information system or systems environment assists an individual in performing his or her portfolio of tasks.

Figure 3.2: Task-Technology Fit

Source: Goodhue and Thompson (1995)
The components of the TTF model embrace certain characteristics concerning task, technology, task-technology fit, usage (utilisation) and performance impact (see Figure 3.3).

**Task** is an action carried out by individuals in turning inputs into outputs (Goodhue & Thompson 1995, p. 216). Task characteristics of interest include those that might induce the user to rely more heavily on certain aspects of the information technology. For example, this includes relying on the database of the operational IS in order to process queries. Task characteristics, according to Goodhue & Thompson (1995), comprise the following constructs: non-routiness, interdependence and job title.

**Technology** is a tool used by individuals in carrying out their tasks. In the context of IS research, ‘technology’ refers to both computer systems (hardware, software and data) and user support services (training, helpline, etc.) provided to assist users with their tasks (Goodhue & Thompson 1995, p.216). **Utilisation** is the behaviour of employing the technology in completing tasks. Measures such as the frequency of use or diversity of application are employed (Davis 1989). **Individuals** may use technology to perform their tasks, and their training, computer experience and motivation affect how easily they utilise the technology.

**Task-Technology Fit** represents the degree to which technology assists an individual in performing their task portfolio and **Performance Impact** refers to the context relating to the accomplishment of their task portfolio by an individual (Goodhue & Thompson 1995 p. 216). The Task-Technology Fit stream of research provides a powerful insight that even well implemented technologies do not on their own generate performance improvement, since the key for achieving good performance is a match between technology and task by the user (Goodhue & Thompson 1995). Thus, in the present context, it is anticipated that in order to fully utilise the ERP system, the functionalities it offers should align with user task requirements. This will result in task-technology fit (dimension of TTF) and subsequently help to improve the organisation performance. The rationale behind this is that users use technologies like ERP to complete their tasks only if the functions available fit their task activities (Palvia & Chervany 1995). If the technology does not offer sufficient advantage, they might not use the system. The unavailability of functions provided by an ERP system (technology) results in end users unable to meet the requirements of the task; hence they will search for another available option. Therefore, the unavailability problem that was discovered from the exploratory study is partly influenced by the technology characteristics of the TTF.
Based on the TTF model, at any given level of usage issue, a system with a higher degree of TTF will perform better, since it is more likely to meet an individual's tasks needs. In general, a good fit between task requirements and IS functionalities increases the chance of a high level of usage of the IS and results in users of that IS working more effectively (Benslimane, Plaisent & Bernard 2002). In compliance with TTF, if an information technology is to be effective, that technology must fit the task performed by the individual who uses the technology. When there is a correspondence between IS functionalities and task requirement, then the information technology system (information systems, policies and staff) has a positive impact on performance. On the other hand, when the gap between the requirements of a task and the functionalities of a technology widens, performance drops (Goodhue & Thompson 1995). Thus, systems with higher TTF will lead to better performance at any given level of usage, since they are more likely to meet the task needs of individuals. In the present context, it is therefore assumed that for an ERP system to be fully utilised, its functionalities should match the users’ task requirements.

Problems of task-technology misfit occur when an ERP system is unable to cater for some of the requirements of the various tasks. This misfit can be related to data format, operating procedures and/or output, and forces companies to customise the ERP (Soh, Kien & Tay-Yap 2000). Prior studies have indicated that there is no ERP implementation success without first resolving those misfits (Hong & Kim 2002; Soh, Kien & Tay-Yap 2000).

### 3.3.2.2 The Gap Framework

The Gap Framework was developed by Behrens & Seder (2004) through an exploratory single case study method with grounded theory coding techniques approach. Based on the framework, the emergence of a shadow system in an ERP environment is explained by a gap that implies a distance between the requirements of stakeholders of the organisation and the functionalities of an ERP system (Behrens & Seder 2004, p. 1725). A specific set of contextual conditions, called causal and intervening conditions, leads to the formation of the Gap Framework.

The causal condition influences the gap distance, which is the distance between users’ requirements and what an ERP system offers, whereby a wide gap leads to the presence of a shadow system. The causal condition is represented by people, business process, organisation and technology. The nature of a shadow system depends on the intervening conditions, namely the resources and support available in the company. Figure 3.2 illustrates
seven constructs and their proposed relationships that constitute the Gap Framework: people, business process, organisation, technology, resources, support and shadow system. The definitions of each of the constructs based on the Gap Framework (Behrens & Sedera 2004) are as follows.

**Figure 3.3: Gap Framework**

![Gap Framework Diagram]

*Source: Behrens and Sedera (2004, p. 1722)*

**People** refer to participants in the organisations who are responsible for functional and administrative tasks (Behrens & Sedera 2004, p.1719). **Business Process** is the performance of work within the division that constitutes tasks such as information processing and communication (Alter 2002). **Organisation** is concerned with the structural establishment of the enterprise as a whole that is based on the administrative and functional unit (Behrens & Sedera 2004, p. 1717). In the context of this research, Behrens and Sedera postulate ‘organisation’ as pertaining to a university (the case studied) and its organisational units of chancellery, faculties and departments (Behrens & Sedera 2004, p.1719). **Technology** refers to tools and techniques (not necessarily IT-based) that are available to people for meeting their task requirements (Behrens & Sedera 2004, p. 1720).

For the intervening conditions, **resources** signifies the wealth available for the development and maintenance of shadow systems that include people, their skills base and time (Behrens & Sedera 2004, p. 1720), whereas **support** constitutes the encouragement, either formal or informal, given to the development of a shadow system (Behrens & Sedera 2004, p. 1720).
In the view of the Gap Framework, organisation category represented by resources and control can be used for informing the organisational antecedent factors, while the people category can be used for user factors. Technology signifies the technology-related antecedent factors.

3.3.2.3 Computer Self-Efficacy

‘Computer self-efficacy’ refers to ‘a judgment of one’s capability to use a computer in the accomplishment of a task’ (Compeau & Higgins 1995, p. 192). As further stated by Compeau and Higgins (1995, p. 192), computer self-efficacy does not refer to what one person has done in the past, but rather to judging what can be done in the future. Moreover, computer self-efficacy does not imply a simple set of skill components (formatting a disk, entering a formula into a spreadsheet, etc.), but instead it incorporates judgments of individuals’ ability to apply those skills to broader tasks (analyses of financial data, producing financial reports, etc.) (Compeau & Higgins 1995, p. 192). Computer self-efficacy judgment consists of three distinct but interrelated dimensions: magnitude, strength and generalisability (Compeau & Higgins 1995). First, the magnitude of computer self-efficacy reflects the level of capability expected. Second, the strength of computer self-efficacy refers to the level of conviction about the judgment. Third, the generalisability of computer self-efficacy refers to the extent to which the judgment is limited to a particular domain of activity.

3.3.2.4 Organisational Factors that Explain End Users’ Problems with ERP

ORGANISATIONAL FACTORS are the first dimension forming the antecedent factors domain. The Gap Framework suggests that organisational factors are characterised by arrangements (arrangement of the organisational unit) and role positions (functional and administrative roles), influencing the development of shadow system, whereby resources and control are the intervening conditions (Behrens & Sedera 2004). In the context of this thesis, although the organisational factors from the Gap Framework represent the antecedent factor category, some modifications have been made. Two constructs embodying organisational factors were adapted from the Gap Framework in the development of the initial conceptual framework (see Figure 3.3). These two constructs are resources and control.
In this research context, the construct identified from the Gap Framework that is organised in the causal condition – people; business processes; organisation and technology and intervening condition; resources; and support – is used to develop the initial conceptual framework. The adoption of the Gap Framework provides a theory for explaining the phenomena: why and how things happen in the context of ERP system usage. This is in line with Gregor’s (2006) proposal of five interrelated types of theory: (1) theory for analysing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting and (5) theory for design and action.

The use of the Gap Framework in this study fits the second type of Gregor’s theory, the theory for explaining. Gregor (2006) contended that theory for explaining is concerned primarily with how and why a particular phenomenon occurs and relying on varying views of causality and method of arguments (p. 619). Thus, the Gap Framework construct is used mainly to explain the causal factors that contribute to ERP system usage problems and to provide insights into factors leading to usage issues faced by end users. The selection of these constructs from the Gap Framework is deemed appropriate because the definition of resources offered by Behrens and Sedera (2004) fits this research context. This is because resources signify not only the capital in the sense of funds but also human capital (people, their skill base and time). Failure to allocate adequate resources (funds) would jeopardise the effective use of an ERP system that is reflected through usage issues. Control is also prevalent in the present study since lack of control results in ERP problems such as data issues, as evidenced in the exploratory study.

Behrens and Sedera (2004) suggested resources as the accessibility of human resources, funding and time in the organisation that determine priority allocation and hence are made available to each division or department (Behrens & Sedera 2004). With respect to this thesis, ‘resources’ indicates the availability of human resource skills and expertise in using ERP systems. Additionally, the resources construct also includes the availability of funds in the organisation to finance the ERP system’s maintenance and upgrading. If funds are not available to support ERP system operations such as training, upgrading, customisation of the functionalities, maintenance and others, users are discouraged from using the system. This is reflected through emerging usage problems. The unavailability of resources (training, funds and expertise) can lead to usability problems faced by end users.
The second construct under organisational factors is **control**. In the original Gap Framework by Behrens & Sedera (2004), control was described as ‘property’ that belongs under ‘people’ constructs (pp.1717). They suggested that the dimension of control ranges from either ‘in command’ or ‘no control’. Based on this, they argued that prior to the ERP implementation many divisions were in control of how certain operations relating directly to their division were performed. In this sense, they were in control of these particular business processes. After the ERP system was implemented, they were no longer in control of many of the works, hence less amount of control held by people resulted in the emergence of the shadow system (Behrens & Sedera 2004, pp.1719).

Control as postulated by Behrens and Sedera (2004) indicates the feeling of control that people can have while they are working. Inadequate control occurs when users feel that they are no longer in control of many of their work processes after an ERP system is implemented. In this research context, borrowing the concept of control from Behrens and Sedera (2004), it was used to explain the antecedent factors within the organisation factors domain that lead to end-users’ problems with ERP. Diverse problems encountered by users in using ERP could also be caused by inadequate control enforced by organisations (Ignatiadis & Nandhakumar 2009). However, for the purpose of this thesis, control implies the coordination of activities in a work system by using ERP. Hence, ERP system usage problems result from inadequate control by the organisation.

### 3.3.2.5 User Factors That Explain End Users’ Problems with ERP

The second dimension of the antecedent factors domain is **USER FACTORS**. User factors are identified based on: (a) the people dimension of the gap framework, (b) the magnitude, strength, and generalisability of CSE and (c) individual characteristics from TTF.

First, the people dimension of the Gap Framework, which was been described in Section 3.3.2.1, comprises: (1) **expectation**, which means what people perceive or are told will happen after ERP implementation, (2) **relationship**, which refers to the relationship between staff members prior to and after the implementation of an ERP system and (3) **control**, which signifies the amount of control people in the organisation feel they have over their work processes (Behren & Sedera 2004).
Second, computer self-efficacy judgement consists of three distinct but interrelated dimensions: magnitude, strengths and generalisability (Compeau & Higgins 1995). Definitions of the three dimension of CSE are provided in Section 3.3.2.3.

The third relevant construct is the individual characteristics from TTF (Goodhue & Thompson 1995). According to Goodhue and Thompson (1995), individuals may use technology to assist them in the performance of their task. Individual characteristics such as training, computer experience and motivation could affect how they utilise the technology.

Computer self-efficacy (CSE) plays a significant role in the use of systems and even in helping individuals to more easily acquire many of the skills associated with effective computer use (Marakas, Yi & Johnson 1998). Therefore, the computer self-efficacy concept is very relevant to the present study’s context. Two of the three dimensions of computer self-efficacy (magnitude, strength) were selected as antecedents of user factors to ERP system usage. The selection of magnitude and strength is relevant to the present context since the lack of both factors would affect ERP system usage. This is because although an ERP system is a technologically sophisticated system, it is meaningless if end users are not willing to use it due to lack of computer self-efficacy (Kwahk & Ahn 2010). Lack of computer self-efficacy in this context originates from a low confidence level for using the system (individual strength) or a perception that they would be unable to accomplish difficult SAP tasks (magnitude). The utilisation of the computer self-efficacy construct is relevant in the present research context. Similarly to the application of the Gap Framework, the application of the computer self-efficacy construct explains the influence of user factors to ERP system usage issues. This is in line with Gregor’s (2006) proposal of the use of theory for explanation.

Users who lack individual strength (confidence) to use an ERP system effectively might perceive the ERP system as very complex (Compeau & Higgins 1995). This would lead to usage issues such as system or data problems when end users opt for alternative systems such as creating their own information system or even a workaround ERP system in order to cope with the issues in accomplishing their tasks. On the other hand, ERP users with high computer self-efficacy (magnitude) might perceive themselves as able to accomplish more difficult computing tasks through an ERP system than those with judgments of lower self-efficacy (Compeau & Higgins 1995). Therefore, they might require less support and assistance in operating the system (ERP). Users’ lack of magnitude also contributes to ERP usage problems such as system usability.
**Generalisability** refers to limiting the judgment of computer self-efficacy to a particular domain or domains. In a computer and IT context, these domains might be considered to reflect different hardware and software features. As a result, individuals with high computer self-efficacy generalisability would expect to be able to competently use various software packages and computer systems. Conversely, those with low computer self-efficacy generalisability would perceive their capabilities to be limited to particular software packages or computer systems. In the present context, this construct was not suitable to explain why ERP usage problems occurred and thus was excluded from the user domain. This is because the usage issues relate solely to an ERP system. It is not the aim of this thesis to explore how the CSE generalisability factor could also affect the use of other software and/or systems. Besides, this study is not intended to compare an ERP system with other system usage problems.

### 3.3.2.6 Technology Factors that Explain End Users’ Problems

The third dimension of the antecedent factors domain is TECHNOLOGY FACTORS. The technology factors domain is identified based on: (a) the Gap Framework and (b) the technology characteristics of the TTF. While technology factors in the Gap Framework (Behrens & Sedera 2004) imply tools and techniques (not necessarily IT) available to people to meet their work requirements, technology characteristics based on TTF are viewed as tools used by an individual in carrying out their tasks (Goodhue & Thompson 1995).

While the technology characteristics of TTF are associated with: (1) the information system used by individuals and (2) the department of an individual (Goodhue & Thompson 1995, p. 222), the Gap Framework offers five concepts to explain technology: functionality, infrastructure, affordances, reliability and the development paradigm (see Section 2.3.3 for a detailed description of each of these constructs). The technology concept based on the Gap Framework offers a broader context and both the first technology characteristics of TTF resemble the functionality concept of the Gap Framework. The use of the TTF construct, similar to the Gap Framework as described earlier, falls under the second type of theory for explaining phenomena, as proposed by Gregor (2006), to explain how technology factors shape the usage of an ERP system, which is the primary concern.

In this study, ‘the technology’ refers to the ERP systems technology. Two main constructs are used to explain the technology factor dimension: affordance and system reliability. **Affordance** suggests what functionalities and operations could be offered by an ERP
system. A particular technology may be very limited in scope, providing only a single function. On the other hand, a technology may provide many and varied functionalities and can be multi-faceted in nature. The affordance construct in this research context refers to the functions and operations provided by ERP systems. The misfit in this construct seems relevant in explaining the causal factor domain. The gap between the affordance of an ERP system and users' requirements causes the emergence of ERP usage problems. For example, ERP functions and operations may be inadequate.

System reliability refers to the dependability of access to and the up-time of systems. It has been suggested that if a system is not reliable, the system somehow crashes and users then use their experiences and training in order to accomplish the task (Goodhue & Thompson 1995). Affordance and systems reliability can influence an ERP system’s usage and the potential problems users might face. System reliability is based on the task-technology fit theory. It is regarded as the dependability of access to and the up-time of systems. Systems reliability is considered to be an important dimension of task-technology fit that significantly predicts usage and users’ performance (Goodhue & Thompson 1995). System reliability is closely and significantly related to usage, but does not have a significant relationship with performance impact. System reliability is described as a driving force of usage since if the system is not reliable, people will tend to not use the system (ERP). System reliability in this context refers to the accessibility and the up-time of an ERP system and includes the ability of an ERP system to consistently produce the same results.

Both affordance and system reliability can influence the usability of an ERP system and the potential problem users might face. If the ERP system is not reliable, it would be undependable and underutilised. In this case, the users would use their experience and training to accomplish their tasks but ERP usage problems would still emerge.

3.3.2.7 Task Factors That Explain End Users’ Problems

Finally, TASK FACTORS can affect the extent of the problems end users might encounter in working with ERP. Task factors are drawn from the task characteristics of the TTF devised by Goodhue and Thompson (1995). The two constructs explaining task factors of TTF are: (1) non-routineness and (2) task interdependence.
**Task interdependence** refers to the degree to which individuals perceive that they interact with and depend upon others to accomplish their work (Lin, T-C & Huang 2008). People whose tasks and performance depend highly on others are likely to share information, knowledge and materials (Stewart & Barrick 2000). A higher degree of task interdependence leads to greater coordination and innovative information.

The task interdependence construct is applicable in this study’s context because in performing one task, individuals are relying other people to perform their own tasks. Lack of task interdependence results in lack of inter- or intra-departmental collaboration, which is predicted to contribute to various usage problems (system or data quality). Additionally, to cope with ERP usage problems in the context of a highly task interdependent structure, users would employ the alternative mechanisms that are described in more detail in the next section. This argument is parallel with earlier research by Strong & Miller (1995) on MRP systems, which were usually deployed in serially interdependent production lines. Strong, Volkoff and Elmes (2001) found that users develop workaround to circumvent system-imposed constraints even for more structured tasks. When a system (ERP) does not accommodate legitimate organisational needs, users often and purposely deviate from the formally sanctioned system (Boudreau & Robey 2005).

**Non-Routineness** is based on Goodhue & Thompson (1995, p.221) and refers to lack of analysable search behaviour. Goodhue and Thompson claimed that the strongest effect of task characteristics on TTF was from non-routine tasks. Individuals who are engaged in more non-routine tasks rate their information system lower in terms of data quality, data compatibility, data locatability, training/ease of use and difficulty in getting authorisation to access data. People are constantly forced to use the IS to address new problems due to the non-routine nature of their jobs. Thus, they are making more demands on the system and are more aware of its shortcomings. With respect to the current research context, non-routine jobs performed through ERP increase users’ dependency on the system and thus increase their awareness of usage problems.

### 3.3.3 Third Domain: Coping Mechanisms

The coping mechanism domain represents mechanisms that overcome problems encountered in using ERP. Use of alternatives systems such as Microsoft Excel, Project and Access was frequently cited as the strategy to overcome the deficiency of an ERP system. Such practices are consistent with the concepts of shadow system (Behrens & Sedera 2004),
workaround systems (Poelmans 1999) and feral systems (Houghton & Kerr 2006). A ‘shadow system’ is ‘a system which replicate in full or in part data and/or functionality of the legitimate system in the organisation’ (Behrens & Sedera 2004, p. 1713). Houghton and Kerr (2006, p. 137) define ‘a feral system’ as ‘an information system (computerised) that is developed by individuals or group of employees to help them with their work, but is not condoned by management nor is it part of the corporation’s accepted information technology infrastructure. Its development is designed to circumvent existing organisational information system’. A ‘workaround’ is described as ‘a coping strategy that deviates from strategies that have been defined in the work flow system (WFS). End users work around the system to save the time or efforts or to avoid the limitations of the WFS’ (Poelmans 1999, p. 11).

While the terms ‘feral’, ‘shadow’ and ‘workaround’ systems are sometimes used interchangeably, Houghton and Kerr (2006) argued that feral systems are not the same as workarounds because a workaround is created with the intention to bypass a recognised problem and to fix the problem temporarily (Koopman & Hoffman 2003; Poelmans 1999). Feral systems, on the contrary, are deliberate attempts to permanently circumvent a fully functional and operationally sound system. Therefore, while all feral systems can be classified as workaround systems, the reverse is not true. As such, workarounds become feral systems only when they are user created and their usage is outside the formal information system. For example, Koopman & Hoffman (2003) reported how end users created a workaround system by modifying input data and operations to compensate for the deficiencies of a formal system.

In a similar way, Behrens (2009) reported on a workaround system that covertly replicates the data and functionality of a formally sanctioned system by operating at the fringes of an organisation. Boudreau & Robey (2005) also reported how users work around an ERP system after its implementation in a large government agency. Their findings indicated that despite the transformation agenda accompanying the new ERP system, users initially choose to avoid using the system as much as possible and later work around the system constraints in unplanned ways.

Based on the findings of the exploratory study and the literature on workaround (Koopman & Hoffman 2003; Poelmans 1999), shadow system (Behrens & Sedera 2004) and feral system (Houghton & Kerr 2006), it is argued that users tend to use a feral system to cope with the problems they face in using ERP systems. One notable observation from the literature is that the concept of ‘system’ in feral, shadow and workaround systems has not always been clear. Some authors have proposed the concept of ‘system’ in ‘feral system’ as ‘information
system’ (Behrens & Sedera 2004; Houghton & Kerr 2006), while others define it as a strategy (Poelmans 1999). The ‘system’ also sometimes refers to a fully functional information system which has been created outside accepted the ERP system (Behrens 2009; Houghton & Kerr 2006) or the use of personal software such as Microsoft Excel and Microsoft Access (Houghton & Kerr 2006; Kerr, Houghton & Burgess 2007).

On the basis of the above and the review of prior literature (see Section 2.4), this study proposes four types of coping mechanisms belonging to the two general forms of problem-focused and emotion-focused. Within the problem-focused form, the two types proposed are: (i) feral information systems and (ii) feral use of information technology and feral data (a by-product of feral use of IT). Within the emotion-focused form, the two types of coping mechanisms are: (iii) endure and (iv) inaction/ignore problem. These four types of coping mechanisms become an important feeder which informs the theoretical background for the coping mechanisms domain of this thesis (see Figure 3.1).

3.3.3.1 Feral Information Systems

A feral information system (feral IS) refers to an information system created and used by individuals or groups that is intended to either supplant or supplement a formal organisational information system (Houghton & Kerr 2006; Spierings, Kerr & Houghton 2012; Thatte & Grainger 2010; Thatte, Graigner & McKay 2012). Feral information systems are created as comprehensive or complete systems with many elements that are highly interrelated and interconnected. The characteristics of feral information systems are that they are reasonably well built, have some degree of sophistication in their functionality, and provide mechanisms for inputting data, processing it and extracting output (Urus, Molla & Teoh 2011a). Feral information systems are usually non-sanctioned systems and operate outside an ERP system environment. An example of a feral information system reported in the literature is MyInfocom or Webfuse. Both examples are learning management systems that provide most of the functionalities of commercial learning management systems, as reported by Behrens (2009) and Jones et al. (2004).

Houghton and Kerr (2006), the pioneers of those who introduced the feral information system concept, also known as the feral system, suggested that among the evidence of its existence is the use of a fax machine to send work orders rather than using the ERP system and also the creation of ‘grass stock’ or ‘long grass stock’, which is an inventory of stock kept in places other than warehouses for possible emergency situations. Houghton and Kerr
added that grass stock records are usually recorded on spreadsheets or databases that are totally separate from the ERP system. According to Houghton and Kerr (2006), it is ERP users' lack of trust in the centralised inventory system of the ERP in response to emergency situations that leads to the development of grass stock.

The existing literature is equivocal about the impact of feral information systems. Some studies have associated feral information systems with a negative impact (Behrens 2009; Behrens & Sedera 2004; Houghton & Kerr 2006). For instance, one of the biggest concerns about the implementation of a feral information system, as pointed out by (Behrens 2009), is the lack of control. The IT environment is usually regulated and controlled by the IT division, but this does not apply to feral information systems, which exist outside the predefined structure that regulates and controls IT. This is in line with the findings of Ignatiadis and Nandhakumar (2009) that the use of feral information systems tends to lessen operational efficiency with consequently decreased organisational control. Yet, despite the negative impact of a feral information system, it is considered one of the important coping mechanisms since feral information technology encompasses the provision of information and functionality which meets the needs of the individual departments in the organisation (Behrens & Sedera 2004, p. 1714).

3.3.3.2 Feral Use of Information Technology

_Feral use of information technology_ (feral IT) refers to the use of information technology by end users to either supplant an ERP system function or to supplement the limitations of an ERP system. It usually includes the development and operation of self-built applications and is dominated by personal software such as Excel or Access (Rentrop & Zimmermann 2012; Sherman 2004). This is demonstrated through Microsoft Excel being used for the customisation of reporting as described in the exploratory study. Examples from the literature include the report of Kerr, Houghton et al. (2007) on how Excel and Access are used for planning outside the SAP system and how that leads to little or no visibility of the plan to the organisation so that it is not reflected in the corporate plan. Ignatiadis and Nandhakumar (2009) also reported a feral use of IT (Excel) for report generation in the form of further processing of data produced by SAP and as a medium of communication which has resulted in portraying a false picture of the company.
The findings of the exploratory study indicate that users often rely on the feral use of IT to cope with the unavailability of essential ERP functions or because they perceive that the ERP way of doing things is complex. As such, IT is used to ‘work around’ the ERP system instead of as a ‘workaround system’. This is consistent with previous research which found that feral IT is used to fill gaps in user requirements that result from flaws in the formal system (Behrens & Sedera 2004; Sherman 2004; Behrens 2009); that it is easy to develop and cost-saving (Bayan 2004; Behrens & Sedera, 2004; Sherman 2004, Raden 2005); that it focuses on business requirements and specifications (Bayan 2004); and that it appears to be faster and more dynamic than the formal system of ERP (Bayan 2004; Sherman 2004).

Feral information systems and feral use of IT can lead to the third type of feral system, which is referred to as Feral Data. ‘Feral data’ refers to data stored outside a formal system such as ERP. From the survey and interview results of the exploratory study, it was found that users often pull data out of ERP and then rely on manual records that they create in Excel. Likewise, in the literature, it is reported that users often extract data from a formal system such as ERP and make necessary adjustments or modifications as needed (Kerr & Houghton 2008; Kerr, Houghton & Burgess 2007). However, when those users fail to integrate the data back into the formal system for operational, forecasting or knowledge management purposes, this can lead to the data being out of sync with formal systems and becoming feral data. Kerr & Houghton (2010) discussed an example of a feral data ‘grass stock’ which was different from the actual data reported in the ERP system and led to inaccurate forecasting and business analytics output (Kerr & Houghton 2010).

To encapsulate, findings from the exploratory study have identified three types of coping mechanisms: feral information system, feral use of technology and feral data, as shown in the coping mechanisms domain (see Figure 3.1).

### 3.4 SUMMARY OF THE CHAPTER

This chapter proposed the initial conceptual framework based on the literature review and the findings from the exploratory study. The initial model is based on three main domains: End User Problems, Antecedents Factors and Coping Mechanisms. For the ERP use problem domain, the analysis from the exploratory study suggested four categories of ERP usage problems: unavailability of functions, system underutilisation, data incompleteness and interface problems. These become the initial constructs for the theoretical framework of the first domain. For the second domain, Antecedent Factors, the constructs selected to
inform the causes of ERP usage issues were taken from the lens of Gap Framework, the Task-Technology Fit theory and the Computer Self-Efficacy concept. Development of the third domain, Coping Mechanisms, of the initial conceptual framework was also based on the results from the exploratory study. It comprises feral information system, feral user of technology (feral IT) and feral data. This chapter highlights the individual initial construct based on the adopted theories and concepts.

Table 3.3 summarises the basic definitions used in developing the initial conceptual framework. This chapter serves as a preamble to Chapter 4 on research methodology.

**Table 3.3: Summary of Basic Definitions Used for the Initial Framework**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Concept</th>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem</td>
<td>End Users’ Usage Problem Domain</td>
<td>Problem encountered by end user in using ERP system during the post-implementation phase</td>
<td>Elbertsen, Benders &amp; Nijssen (2006); Soja &amp; Paliwoda-Pekosz (2009); Topi, Lucas &amp; Babaian (2005)</td>
</tr>
<tr>
<td>Unavailability of Functions</td>
<td>Lack of SAP functionality to perform a required task in a timely way</td>
<td>Based on ISO EC 9126</td>
<td></td>
</tr>
<tr>
<td>System Underutilisation</td>
<td>SAP features have not been fully exploited by SAP users</td>
<td>Jaspersen, Carter &amp; Zmud (2005)</td>
<td></td>
</tr>
<tr>
<td>Data Incompleteness</td>
<td>Omission of or incomplete data entered into SAP</td>
<td>Ballou &amp; Pazer (1985)</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>SAP’s screen has not been designed in an attractive way for SAP users</td>
<td>Longinidis &amp; Gotzamani (2009)</td>
<td></td>
</tr>
<tr>
<td>Antecedent Factor (User)</td>
<td>Control</td>
<td>The governance of SAP system through the availability of the control mechanism</td>
<td>Behrens &amp; Sedera (2004)</td>
</tr>
<tr>
<td>Resources</td>
<td>The availability of funds in the organisation to finance the SAP system’s maintenance and upgrading, training and people to provide users with skills and expertise in SAP system use</td>
<td>Behrens &amp; Sedera (2004)</td>
<td></td>
</tr>
<tr>
<td>Antecedent Factor (User)</td>
<td>Magnitude</td>
<td>The ERP (SAP) users with low SAP self-efficacy in SAP perceive themselves as unable to accomplish difficult SAP tasks</td>
<td>Compeau &amp; Higgins (1995)</td>
</tr>
<tr>
<td>Individual Strength</td>
<td>Level of conviction about the judgment and confidence of users with regard to their ability to carry out the tasks by using SAP</td>
<td>Compeau &amp; Higgins (1995)</td>
<td></td>
</tr>
<tr>
<td>Antecedent Factor (Technology)</td>
<td>Affordance</td>
<td>The functions and operations which are provided by technology (ERP)</td>
<td>Behrens &amp; Sedera (2004)</td>
</tr>
<tr>
<td>System Reliability</td>
<td>The dependability of access and uptime of system</td>
<td>Goodhue &amp; Thompson (1995)</td>
<td></td>
</tr>
<tr>
<td>Domain</td>
<td>Concept</td>
<td>Definition</td>
<td>Reference</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Antecedent Factor</td>
<td>Task Interdependence</td>
<td>The degree to which individuals interact and depend upon others to accomplish their work via ERP system</td>
<td>Campion, Medsker &amp; Higgs (1993, p. 827)</td>
</tr>
<tr>
<td></td>
<td>Non Routines</td>
<td>Lack of analysable search behaviour</td>
<td>Goodhue &amp; Thompson (1995)</td>
</tr>
<tr>
<td>Task-Technology Fit</td>
<td></td>
<td>The degree to which technology assists an individual in performing his/her portfolio of task</td>
<td>Goodhue &amp; Thompson (1995)</td>
</tr>
<tr>
<td>Coping Mechanisms</td>
<td>Feral Information System, Feral Use of Information systems, Feral Data</td>
<td>The coping mechanisms employed in dealing with ERP system usage problems</td>
<td>Behrens &amp; Sedera (2004); Houghton &amp; Kerr (2006); Gasser (1986); Ignatiadis &amp; Nandhakumar (2009)</td>
</tr>
<tr>
<td>Individual concepts use as Coping Mechanisms for ERP system use problems</td>
<td>Feral Information Systems</td>
<td>An information system (computerised) that is developed by individuals or group of employees to help them with their work, but is not condoned by management nor is part of the corporation's accepted information technology infrastructure. Its development is designed to circumvent existing organisational information system</td>
<td>Houghton &amp; Kerr (2006, p. 137)</td>
</tr>
<tr>
<td></td>
<td>Feral Use of Information Technology</td>
<td>Use of Information Technology by end users to either supplant an ERP system function or supplement the limitations of an ERP system</td>
<td>Author’s Definition</td>
</tr>
<tr>
<td></td>
<td>Feral Data</td>
<td>Data that are stored outside the formal system (such as ERP)</td>
<td>Author’s Definition</td>
</tr>
<tr>
<td></td>
<td>Endure</td>
<td>Endure problems rather than actively try to reduce them</td>
<td>Benamati &amp; Lederer (2001 p.40)</td>
</tr>
<tr>
<td></td>
<td>Inaction/ Ignore</td>
<td>Do not taken any necessary action but ignore the problem</td>
<td>Benamati &amp; Lederer (2001 p.40)</td>
</tr>
</tbody>
</table>
4.1 INTRODUCTION

The theoretical framework that serves as the foundation of this study was established in Chapter 3. By adopting important constructs from Task-Technology Fit theory and the Gap Framework, this study intends to answer the research questions posed in Chapter 1. The study requires a research design that is appropriate to answer the research questions. A research design is an overall plan for relating a conceptual research problem to relevant and practicable empirical research (Ghauri & Grønhaug 2002). Strategic choices of research methods make it possible to investigate a research problem in the best possible way.

There is no definite right or wrong approach to any research but researchers have to employ an approach that is able to offer them relevant answers to their research questions or issues under examination (Gerson & Horowitz 2002). Additionally, research design must be aligned with the research paradigm being used in a study. The choice of research design can be conceived as the overall strategy to obtain the information wanted and to influence subsequent research activities, for instance, what data to collect and how the data should be collected (Ghauri & Grønhaug 2002).

This chapter starts with the epistemological and methodological positions of the research (4.2). To undertake the research, a qualitative research methodology was employed (4.3). The chapter then describes the research method (4.4) and justifies the data collection for the main study (4.5). Subsequently, data analysis is presented (4.6) and the chapter concludes with the chapter summary (4.7).

The overall research design and methods are illustrated in Table 4.1.
Table 4.1: Summary of Adopted Research Methodology

<table>
<thead>
<tr>
<th>Level of Decision</th>
<th>Choice</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Paradigm</td>
<td>Soft-Positivism Paradigm</td>
<td>Section 4.2</td>
</tr>
<tr>
<td>Research Methodology</td>
<td>Qualitative Research Methodology</td>
<td>Section 4.3</td>
</tr>
<tr>
<td>Research Method</td>
<td>Case Study Research Design</td>
<td>Section 4.4</td>
</tr>
<tr>
<td>Data Collections</td>
<td>Semi-structured face-to-face interviews</td>
<td>Section 4.5</td>
</tr>
<tr>
<td></td>
<td>Review of the documents</td>
<td></td>
</tr>
<tr>
<td>Data Analysis</td>
<td>Open Coding</td>
<td>Section 4.6</td>
</tr>
<tr>
<td></td>
<td>Thematic Coding</td>
<td></td>
</tr>
</tbody>
</table>

4.2 RESEARCH PARADIGM

A paradigm is defined as ‘a basic belief system or world view that guides the investigation’ (Guba & Lincoln 1994, p. 105). To make distinctions between paradigms, various taxonomies are used but they share three fundamental elements: ontological assumption, epistemological assumption and methodological assumption (Guba & Lincoln 1994).

- **Ontology** is the philosophy of reality and the nature and form of reality to constitute legitimate researchable questions (Guba & Lincoln 1994).
- **Epistemology** is the philosophy of knowledge or how we come to know and what counts as knowledge (Guba & Lincoln 1994).
- **Methodological** assumption refers to the procedures that researchers use to investigate what they believe can be known and the rationale behind the procedures (Sarantakos 1998).

A researcher makes claims about reality (ontology), how we know that reality (epistemology) and the process of studying it (methodology). Hence, there is a distinctive relationship between these three philosophical assumptions which provide the framework for understanding the different approaches to research (Guba & Lincoln 1994). There is a range of taxonomies that distinguish paradigms and there are many diverse paradigms. However, the three major dominant paradigms in the social sciences are the positivist, the interpretive and the critical paradigms (Myers & Avison 2002). The differences and similarities between the three paradigms in terms of ontology, epistemology and methodology are summarised in Table 4.2.
Table 4.2: Differences between Positivism, Interpretivism, Critical Realism and Soft-Positivism

<table>
<thead>
<tr>
<th></th>
<th>Positivism</th>
<th>Interpretivism</th>
<th>Critical Realism</th>
<th>Soft-Positivism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ontology</strong></td>
<td>Reality is real and apprehensible</td>
<td>Multiple local and 'constructed' realities</td>
<td>Reality is ‘real’ but only imperfectly and probabilistically apprehensible</td>
<td>Objective reality exists beyond the human mind, but how it is perceived depends on culture and life experiences</td>
</tr>
<tr>
<td><strong>Epistemology</strong></td>
<td>Objectivist: Findings are true</td>
<td>Subjectivist: Created findings</td>
<td>Modified Objectivist: Findings are probably true</td>
<td>Epistemologically, reality can be captured empirically; however, acquired knowledge is context-bound by culture, time, and circumstances</td>
</tr>
<tr>
<td><strong>Common Methodologies</strong></td>
<td>Experiments/ surveys: Mostly concerned with testing of theory and verification of hypotheses</td>
<td>Hermeneutical or dialectical: Researcher is ‘passionate participant’ in the investigated world</td>
<td>Case studies and convergent interviews: Triangulation, interpretation is mainly qualitative but also quantitative methods</td>
<td>Positivist case studies design with important contributions from an Interpretivist analysis and also quantitative methods</td>
</tr>
</tbody>
</table>

Source: Adapted from Guba & Lincoln (1994) ***for the first three paradigms**
Seddon & Scheepers (2006) **for the soft–positivism paradigm**

The underlying research philosophy guiding this study is the **Soft Positivism** paradigm (Kirsch 2004; Leidner, Pan & Pan 2009; Ravishankar, Pan & Leidner 2011; Seddon & Scheepers 2006). Kirsch (2004) suggested that soft positivism is similar to positivism in that it manages to bring some prior expectations to the data analysis. On the other hand, soft positivism is also in agreement with interpretive research that permits explanation derived from emerging data. Through soft-positivism, the research process is designed to reveal pre-existing phenomena and the relationships between them. Kirsch’s (2004) view is supported by Leidner, Pan & Pan (2009) and Ravishankar, Pan & Leidner (2011), who have asserted that in the soft-positivist approach, the phenomena under investigation are relatively stable, exist objectively and represent a factual account of the case. Yet, in order to examine constructs that are not easily separable from their contexts nor limited to pre-identified constructs, the positivist approach is designed to identify other constructs drawn from either the interpretivist approach (Klein & Myers 1999) or grounded theory (Strauss & Corbin 1998).
The selection of the soft-positivism paradigm is based on several reasons as follows.

First, soft-positivism provides a structured but flexible approach to qualitative research as it assists in conducting the data analysis with certain expectations based on a priori theory (Kirsch 2004; Ravishankar, Pan & Leidner 2011). This approach enabled the investigator to draw on the positivist view (Benbasat, Goldstein & Mead 1987; Yin 1994). As was described in Section 3.3, the investigator developed an initial conceptual framework based on the synthesis of the background literature and the results from the exploratory study. This approach is aligned with the positivist view, where the investigator assumes that the ERP system usage issues are stable and objective phenomena. Additionally, by using this approach, the study was designed to reveal preexisting phenomena and relationships between the constructs (Madill, Jordan & Shirley 2000). This was achieved by using pre-defined constructs identified during the development of the framework to be a basis for analysing the data. In the context of this research, the identified constructs of usage problems developed in the initial framework originated from a number of influencing factors structured through the lens of Task-Technology Fit theory and the Gap Framework, which became the basis for the data analysis.

Second, although pre-constructs were identified, yet the approach also allowed for unexpected findings and explanations to emerge from the data, as is more typical in the interpretive approach (Klein & Myers 1999; Walsham 1993). Walsham (1993) asserted that theory based on an interpretive paradigm can be used as part of the iterative process of data collection and analysis, but a theory needs to preserve a considerable degree of openness to the field data (Walsham 1993). It was understood that the initial assumptions and theories would be modified at the later stage of this research. Therefore, by using the iterative process of data collection and analysis, the pre-identified concepts established during the development of the initial conceptual framework can be expanded, revised or even abandoned altogether. In view of this point, the usage of a soft-positivism research approach was deemed suitable for the research context. Also suitable was the interpretive perspective that allows other constructs to emerge from the data. An example is the wide use of ‘feral concept’ as a coping strategy that emerged from the data analysis.

Third, the positivism paradigm examines the cause and effect relationships between objects, which is important in answering certain research questions (Guba & Lincoln 1994). In this study, the relationships are those between ERP usage problems, the antecedents to the problems and the coping mechanisms adopted by end users to deal with usage issues (Seddon & Scheepers 2006). The ‘soft’ position on positivism overcomes the rigid stance of
extreme positivism by looking differently at different situations where generalisation is not always applicable (Seddon & Scheepers 2006).

4.3 RESEARCH METHODOLOGY

This study uses a qualitative research perspective because the qualitative approach is crucial to enable the researcher to gain an in-depth understanding of the issues involved in ERP system usage. Qualitative research enables researchers to study social and cultural phenomena and to understand people and their social and cultural contexts (Myers & Avison 2002). The qualitative researcher views social phenomena holistically (Creswell 2003) or by instilling some meaning (Miles & Huberman 1984).

Based on Creswell (2003), a qualitative approach is ‘one in which the researcher often makes knowledge claims based primarily on constructivist perspectives (i.e., the multiple meanings of individual experiences, meanings socially and historically constructed with an intent of developing a theory or pattern) or advocacy participatory perspectives (i.e., political, issue-oriented, collaborative, or change-oriented) or both’. (p. 18). Miles and Huberman (1984), on the other hand, believed that qualitative research involves how the researcher gives meaning to a social phenomenon/event through contrasting, comparing, replicating, cataloguing and classifying the object of study. The underlying philosophical assumption of the researcher in qualitative research can be positivist, interpretive or critical realist, depending on the choice of the specific qualitative research method (Myers & Avison 2002, p. 5). This study has adopted the soft-positivism paradigm, as discussed in Section 4.3, using the qualitative research method. The selected method was chosen for the following reasons.

First, the researcher was interested in gaining an in-depth understanding of end users’ problems, the antecedent factors to the problems and how users cope with problematic issues. Besides that, this research also explored the relationships between these three research questions. The qualitative method can provide a good understanding and insights into ERP usage problems during the post-implementation phase. The investigator was also able to obtain in-depth information, details and insights into the participants’ experiences of the investigated area of study. This is in accordance with the qualitative research perspective advocated by Johnson (1995), who stated that the advantage of using the qualitative method is ‘the ability of the researcher to engage in research that probes deeper understanding rather than examining the surface features’ (p. 4).
Second, the qualitative method is appropriate for studying human behaviour and behavioural changes (Stevens 2003). In the context of this research, the complex relationships between the problems faced by end users, the antecedent factors to the problems and the coping mechanisms employed to overcome these problems are suitable for qualitative investigative techniques.

Third, qualitative research is appropriate when a little known concept or phenomenon needs to be understood (Creswell 2003, p. 22). Further, Creswell (2003) asserted that qualitative research is appropriate when the researcher is unable to determine the important variables to examine (p. 22). Qualitative research is also used to gain new perspectives on phenomena about which much is already known, or to gain more in-depth information that may be difficult to convey quantitatively. In the context of this research, the synthesis of prior ERP literature suggests that post-implementation ERP research is now capturing the interest of ERP research scholars. Therefore, the qualitative method is appropriate since, to the best of the investigator’s knowledge, this is a pioneering study that integrates post-ERP usage problems with coping mechanisms from the end users’ perspectives. The qualitative research methodology was conducted through a case study method.

Section 4.4 illustrates how the case study strategy was employed in this research.

4.4 RESEARCH METHOD: THE CASE STUDY RESEARCH DESIGN

Different methods are available to collect and analyse information in qualitative research. The choice of research method informs the way in which the researcher collects data. This research used a multiple case study design strategy because case studies are the most widely used qualitative research method in information system research (Benbasat, Goldstein & Mead 1987; Easterby-Smith, Thorpe & Lowe 2002). Various definitions of case studies have been developed by scholars. Yin (1994, p.13) defined ‘case study’ as ‘an empirical enquiry that investigates a contemporary phenomenon within its real-life context especially when the boundaries between phenomenon and context are not clearly evident’. Another definition by Benbasat, Goldstein and Mead (1987, p. 370) is as follows:

A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or few entities (people, groups, or organisation). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used.
Case study research can be positivist, interpretive or critical realist, depending on the underlying philosophical assumptions of the researcher. Yin (1994) and Benbasat, Goldstein and Mead (1987) advocate the positivist method while Walsham (1993) supports the interpretive in-depth case study research strategy. This thesis employed the multiple case studies approach (Eisenhardt 1989) guided by the soft-positivism paradigm (Kirsch 2004; Leidner, Pan & Pan 2009). In designing the case study, the following guidelines were used.

First, the boundary of the theory used in the case study is carefully defined (Shanks 2002). With reference to this point, the investigator provided the boundary of the case studies based on three articulated domains: antecedent, issues and coping. Some of the constructs drawn from the Task-Technology Fit theory, the Gap Framework and the computer self-efficacy concept are intended to explain the antecedent factors domain. Some of the constructs proposed for ERP usage issues and the coping mechanisms domain originated from either the previous literature or the findings of the exploratory study.

Second, phenomena are examined in a natural setting (Benbasat, Goldstein & Mead 1987). The ERP usage issues, antecedent factors and coping mechanisms were investigated in the natural setting of three organisations in Malaysia.

Third, research questions are generated, cited by Yin (1994). The research questions provided a well-defined focus for the study and permitted the researcher to specify the kind of data (i.e., project context, implementation strategies and project success) to be gathered. For this thesis, the main research questions along with three sub-questions were formulated to uncover usage problems encountered by ERP system users in the three organisations in Malaysia. In addition to that, questions about the causes of the usage problems and the coping mechanisms used were also formulated, as reported in Chapter 1.

4.4.1 The Selection of Cases

This study was based on multiple case studies. Case studies can be either single or multiple-case designs. Single cases are used to confirm or challenge a theory, or to represent a unique or extreme case (Yin 1994, pp. 33-40). A single-case study is also ideal for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. Single-case designs require careful investigation to avoid misrepresentation and to maximise the investigator's access to the evidence. These studies can be holistic or embedded, the latter occurring when the same case study involves more
than one unit of analysis (Yin 1994). Multiple case studies, on the other hand, are desirable when the intent of the research is description, theory building or theory testing (Benbasat, Goldstein & Mead 1987). These three correspond to the design, prediction and disconfirmation stages devised by Bonoma (1985). Multiple case studies make it possible to develop a cross-case analysis to extend theory. Each individual case study consists of a ‘whole’ study, in which facts are gathered from various sources and conclusions drawn on those facts. Multiple case study designs allow cross-case analysis and comparisons, and the investigation of a particular phenomenon in diverse settings (Darke, Shanks & Broadbent 1998). Multiple case studies may also be selected to predict similar results (literal replication) or to produce contrasting results for predictable reasons (theoretical replication) (Yin 1994, p. 46).

A multiple case study approach can increase the generalisability of findings, and yield more compelling and robust results than a single case study can (Benbasat, Goldstein & Mead 1987; Yin 1994). However, statistical generalisation to a population is not the goal of case study research, as cases are not sampling units. The multiple cases approach has been suggested to increase the methodological rigour of the study through ‘strengthening the precision, the validity and stability of the findings’ (Miles & Huberman 1984).

Contrary to the common misconception that case studies provide little basis for scientific generalisation, case studies are generalisable to theoretical propositions, even though not to populations or universes (statistical generalisation) (Lee 1989; Yin 1994). Multiple case studies design should allow cross-case analysis and comparisons, and the investigation of a particular phenomenon in diverse settings (Darke, Shanks & Broadbent 1998). By selecting multiple cases (three organisations), the researcher was able to examine the post-ERP usage problem, the causal factors and the coping mechanisms used according to various perspectives and settings.

### 4.5 DATA COLLECTION DESIGN

Four large organisations in Malaysia that had implemented ERP systems were approached. Three agreed to participate; they will henceforth be identified as cases A, B and C. The three organisations were selected by using purposive sampling (Cavana, Delahaye & Sekaran 2001). The selection criteria for these organisations were the following:
(1) The company has implemented an ERP (SAP R/3) system for more than three years and is sufficiently mature to study any ERP system usage issues.

(2) The company has agreed to participate in the study since accessibility issues constitute a critical point in a case study research type.

(3) Based on the purposive sampling, the investigator has some arrangement of access to personnel in each of the cases established during the exploratory study.

Data collection for the main study was conducted from 1 March 2010 to 15 June 2010 in Malaysia. An ethics application was lodged before the data collection took place and approval was obtained from the Ethics Sub-committee of Business College, RMIT University on 23 February 2010 (see Appendix 4.7).

Table 4.3: Overview of Data Collection Design

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>Petrochemical Industry</td>
<td>Automotive Component Manufacturer</td>
<td>Petrochemical Industry</td>
</tr>
<tr>
<td>Purpose of data collection</td>
<td>To gain a deeper understanding of the ERP usage problem, the antecedent factors and coping mechanisms used.</td>
<td>To gain a deeper understanding of the ERP usage problem, the antecedent factors and coping mechanisms used.</td>
<td>To gain a deeper understanding of the ERP usage problem, the antecedent factors and coping mechanisms used.</td>
</tr>
<tr>
<td>Time</td>
<td>March–April 2010</td>
<td>April–May 2010</td>
<td>May–June 2010</td>
</tr>
<tr>
<td>Approach</td>
<td>Face-to-face interviews, document review</td>
<td>Face-to-face interviews, document review</td>
<td>Face-to-face interviews, document review</td>
</tr>
<tr>
<td>Category of Respondents</td>
<td>Managerial level</td>
<td>Managerial level</td>
<td>Managerial level</td>
</tr>
<tr>
<td></td>
<td>End User level</td>
<td>End User level</td>
<td>End User level</td>
</tr>
<tr>
<td>No. of interview</td>
<td>13</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>participants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approval Protocol</td>
<td>Ethics approval from College of Business Human Research Ethics Sub-committee, Business College, RMIT University (Ref No: 1000116)</td>
<td>Ethics approval from College of Business Human Research Ethics Sub-committee, Business College, RMIT University (Ref No: 1000116)</td>
<td>Ethics approval from College of Business Human Research Ethics Sub-committee, Business College, RMIT University (Ref No: 1000116)</td>
</tr>
</tbody>
</table>

Prior to lodging the ethics application, letters of support from the relevant organisations were obtained and they confirmed formal approval to access the organisations. This research phase adopted a triangulation approach for collecting the information needed. The collection of data was based on two data collection techniques: interviews and reviews of relevant documents. Table 4.3 provides an overview of the data collection design and a description of specific data collection methods.
Chapter 4: Research Methodology

4.5.1 Interviews

Interviews make it possible to gather rich data from people in various roles and situations (Myers 2009). The problems concerning ERP use and people’s coping mechanisms were best understood through the interaction between the researcher and ERP system users directly. Myers (2009) has identified three type of interviews: structured, unstructured and semi-structured. Structured interviews refer to questions that are defined in advance and the interviewee has limited choices in answering them. Unstructured interviews have fewer predefined questions and are more open-ended questions that intend to explore interviewees’ opinions in depth.

The semi-structured interview sits between the structured and unstructured variants. Myers (2009) suggested that with semi-structured interviews, predefined questions should be established; however, the answers to the questions are not limited and other questions can be asked during the interview (Myers 2009). This study employed semi-structured face-to-face interviews, which is consistent with the soft-positivism approach adopted and the initial conceptual framework. In designing the interview questions, the researcher was guided by the research objectives and the initial conceptual framework. Three sets of interview guides were prepared for the three different groups: department managers, IT managers and end users (see Appendices 4.1, 4.2 and 4.3).

**Interview Guide for Managers** was prepared for those who are holding the managerial position (senior manager, manager and assistant manager) in the selected organisations. The interview guide intends to discover the manager’s experiences in dealing with the SAP (ERP) system problems and issues faced by their subordinates. Being the manager in the respective organisations (Case A, Case B and Case C), they have a broad knowledge on overall operation. Thus, the use interview guide is aimed to examine their experience in managing the use of ERP system by their subordinates.

**Interview Guide for IT Managers** were meant to gather insight information from the respective personnel as the IT department usually oversee the IT matter. This is especially important in formulating the IT policy that suit the company and also to ensure the organisations’ business objectives are aligned with the IT objective. Acknowledging this fact, the IT personnel (eg, the senior IS executive) is considered to be the most suitable informant, especially if this executive was also at a senior level in the overall organizational hierarchy Johnston & Carrico (1988).
Interview Guide for End-User is intended for those who are using the SAP (ERP) system directly. This includes executives and clerical staff in the respective organisations. This interview guide is important to examine their experience in using SAP, and to what extent they faced challenges, problems and issues while using the system.

4.5.2 Participant Selection

For the main study, the unit of analysis was an organisation that had implemented an ERP system for more than three years and could therefore provide sufficient maturity for the investigator in studying ERP system usage issues, antecedent factors and users' coping mechanisms. Four large organisations in Malaysia that had implemented ERP systems were approached and the total number of interview participants invited was 48 (based on the Ethics Application). However, only three organisations agreed to be involved in this study, with a total number of interview participants of 30. The participants were selected by using purposive sampling (Cavana, Delahaye & Sekaran 2001; Marshall 1996). Based on the purposive sampling the current researcher actively selects the most productive sample to answer the research question as suggested by Marshall (1996). Although only 30 participants from the 48 participants invited, the smaller sample size is considered appropriate for a qualitative study if it would be able to adequately answer the research question (Marshall 1996). The participants were divided into two main categories: managerial level, end users level.

Data collection was carried out for three consecutive months in March–June 2010 in Malaysia. Thirty semi-structured interviews were conducted. The interview questions for the main study were guided by the three research objectives and the initial conceptual framework. Three sets of interview guides were prepared for the three different groups of department manager, IT manager and end user. In each organisation, the first point of contact was the Human Resource Manager, who became the gatekeeper for the selected organisation. Interview participants were identified through purposive sampling.

In Cases A and C (both are subsidiary of PATRON BHD), a Human Resource Manager became the liaison officer. With approval from the top management, the Human Resource Manager then identified the focal person in each department. Then the identified key manager in each department nominated their subordinates to be involved in the interview sessions. Once the lists of participants had been established, the investigator contacted the
Human Resource Manager via email. The interview sessions conducted in Cases A and C lasted between 45 minutes and 1½ hours.

For Case B, 13 participants were involved from two separate interviews groups. The first group was the Group Finance and Corporate Division at the Headquarters (CBCD). There were six participants from CBCD from two departments: MIS and SAP; and the Group Finance Department. Three of the CBCD participants held managerial positions and the other three participants were end users. The second group was at the subsidiary company of Case B (CBSC). For CBSC, there were seven participants from three departments: Finance; Production, Planning and Control; and Purchasing and Vendor Development. Three of the participants held managerial positions and the other four were end users. The process of recruiting participants in Cases A and C was also employed for Case B.

The informed consent form (Appendix 4.4) and the plain language statement (Appendix 4.5) were used in recruiting all participants in the three cases (A, B and C). The approval for the ethics application (Appendix 4.7) and the permission letter to access the organisation were also obtained for the respective cases (Appendices 4.8 and 4.9). Although the initial plan was to carry out about 45 interview sessions, as stated earlier, the actual number of interviews conducted was 30. The reason for this was that there were major changes with the number of participants in Case C. At first, the company agreed to allow 15 people to participate in the study. However, closer to the interview date, the number was drastically reduced to four interviewees only, due to a confidentiality issue (see detail from a summary of Data Quotation Sources for each case in Chapter 5). Table 4.4 summarises the details of the invited and participating interviewees in this study.

Table 4.4: A Summary of Invited and Interviewed Participants

<table>
<thead>
<tr>
<th>Case</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
<th>Case D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of participant identification</td>
<td>Purposive Sampling (Cavana, Delahaye &amp; Sekaran 2001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of participants invited</td>
<td>14</td>
<td>14</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Agreed</td>
<td>13</td>
<td>13</td>
<td>4</td>
<td>Reject the application</td>
</tr>
<tr>
<td>Interviewed</td>
<td>13</td>
<td>13</td>
<td>4</td>
<td>None</td>
</tr>
</tbody>
</table>
4.6 DATA ANALYSIS

The data analysis approach followed a three-stage process of data transcribing, coding and analysing. During the data analysis process, the data were organised categorically and chronologically, reviewed repeatedly and continually coded (Creswell 2003). The following section outlines the data analysis process followed in this thesis.

4.6.1 Data Transcribing

The transcribing process is a very time-consuming and meticulous process, as highlighted by Bryman and Bell (2007), and it is regarded as valuable if done by the researcher because it gives the researcher greater familiarity with the data. All interviews, a total of 1714 minutes (with an average of 57 minutes per interview), were recorded using an MP3 player. A verbatim transcription was done by the researcher, and external notes and documents gathered from the three organisations were used as supporting information whenever required.

On average, between 10 and 12 hours were required to transcribe each interview, with the transcript length varying from 8 pages to 25 pages. It took less than two months (52 days) to complete the transcription of the 30 interviews. The five interviews conducted in a mix of languages (English and Bahasa Malaysia) were translated into English. This step is necessary to facilitate the analysis process as well as to provide consistency in data transcription. After the entire transcription process was completed, the researcher went through the interview transcripts just to ensure that any important information had not been missed out. Subsequently, the data analysis process continued with data coding.

4.6.2 Data Coding

Coding is the process of identifying justificatory statements and developing conceptual categories from them (Yin 1994). Before data coding began, the three research questions were examined to determine the best possible way to code the data. For Question 1, the open coding approach based on Strauss and Corbin (1998) was employed. This approach was selected because at the beginning of the analysing process, open coding is the discoverable process to identify the categories from the data. Although a priori construct of end user ERP problems was identified from the initial framework, open coding was still
relevant since it is intended to prevent the investigator from being ‘constrained’ or ‘contaminated’, or otherwise inhibited from effectively generating categories, their properties and their dimensions (Arunthari 2005). To analyse Questions 2 and 3, the thematic coding approach was followed (Boyatzis 1998; King 1998) because it provides a structured way of understanding how to develop the thematic coding. A detailed description of the coding used is presented in the following two sections.

4.6.2.1 Open Coding

Open coding is the process of breaking down, comparing, conceptualising and categorising data (Strauss & Corbin 1998). Such coding was realised here by comparing each incident, event, quote and instance gathered during the data collection for similarities and differences. To identify the ERP usage problems encountered by end users, open coding was employed based on the guideline proposed by Strauss and Corbin (1998, p. 101). During the open coding process, data were broken down into discrete parts, closely examined, and compared for similarities and differences (McGhee, Marland & Atkinson 2007). By using open coding, categories along with their properties and dimensions were extracted from the raw data. This process was iterative where expressive statements in data were detected and the relationship between them evaluated. Some coding categories initially identified were revised during subsequent coding. Overall, five steps were followed by the researcher to code for the first question and identify the problems that users (operational and supervisory/managerial) face in using an ERP system.

**Step 1:** Reading the transcripts to get an overview of the SAP users’ experiences in each case.

**Step 2:** Analysing the transcripts sentence by sentence to identify any ERP system problem faced by end users and to generate initial codes. The analysis technique in open coding is either word by word, phrase by phrase or sentence by sentence, as suggested by Strauss and Corbin (1998, p. 101). The sentence-by-sentence approach ensured that important information concerning the ERP usage problem was not left out. For this purpose, the investigator assigned different colour codes to differentiate the identified concepts for end user problems. For instance, in the following snapshot in Table 4.5, green represents technical problems and dark brown indicates data untimeliness issues. The same colour code was used consistently for the same concept throughout the 30 transcripts.
Table 4.5: Snapshot of Open Coding – Identification of Concepts (First Stage)

<table>
<thead>
<tr>
<th>P</th>
<th>Quotes</th>
<th>Informant</th>
<th>Open Code (Problem)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 2</td>
<td>‘I believe if they are given proper training they shouldn’t have any major issue. The issue that they encountered is probably on how they report their problem to the respective people. For example, if they have technical problem, they should be able to report to us and we would be able to give them. They face an issue when we (MIS /SAP team) do not give immediate or responsive support.’</td>
<td>P12_ICB_SMM S</td>
<td>Technical Problem</td>
</tr>
<tr>
<td>P1 3</td>
<td>‘It is quite difficult to say since it is not a regular problem. For example, we are facing problem with the network (technical problem). Besides that, they have to discipline themselves in order to key in the data on time (timeliness of the data). For instance, they need to key in the goods received immediately so that it must be in a real-time basis (timeliness of the data). Otherwise, it will affect the related process. However, practically it does not happen. It is not good and not really up to the required level.’</td>
<td>P13_ICB_MMS</td>
<td>Technical Problem Timeliness of the data</td>
</tr>
</tbody>
</table>

*P* participants

From the first level of the extracting process, 121 initial codes were identified; of which 37 were unique initial codes (that is, the total initial codes minus repetitions) (see Table 4.6).

Table 4.6: List of Unique Initial Codes for ERP Problems

<table>
<thead>
<tr>
<th>Participants</th>
<th>Initial Codes (121)</th>
<th>Unique Codes (37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Unavailable function (analysis) Underutilisation of system Interoperability problem</td>
<td>Unavailable function (analysis) Underutilisation of system Interoperability problem</td>
</tr>
<tr>
<td>E2</td>
<td>Unavailable function (scheduling) Unavailable function (reporting and storage) Unavailable customised function Unavailable function (analysis) Underutilisation of system Poor interface</td>
<td>Unavailable function (scheduling) Unavailable function (reporting and storage) Unavailable customised function Unfriendly interface design Unavailable function (notification) System complexity Inaccuracy of data Difficult to learn Unattractive interface Setting problem Unfriendly textual interface Unfriendly screen layout Complex screen design Unfriendly interface due to unfamiliar technology Technical problem Unavailable function</td>
</tr>
<tr>
<td>E3</td>
<td>User unfriendliness interface Unavailable function (notification) Unavailable function (scheduling) Unavailable function (analysis) System complexity Inaccuracy of data</td>
<td></td>
</tr>
<tr>
<td>Participants</td>
<td>Initial Codes (121)</td>
<td>Unique Codes (37)</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>M4</td>
<td>User friendliness interface System complexity Unavailability of function (notification) Difficult to learn Inaccuracy of data</td>
<td>Not capable to learn Untimeliness of data Poor screen layout Network problem (Infrastructure) Poor screen design Missing information (Incompleteness) Awkward screen – interface problem Incompleteness of data Do not like to use and learn Missing data Data is omitted (incompleteness) Missing input (Incompleteness) Complex system features Server slow (infrastructure) Difficult to understand Boring screen design (unattractive design) Technical infrastructure Difficult to use and understand</td>
</tr>
<tr>
<td>E5</td>
<td>Unfriendly interface Unavailable function (notification) System complexity Interoperability Issue Underutilisation of system Unattractive Interface Difficult to learn</td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>System complexity User unfriendliness interface Setting problem</td>
<td></td>
</tr>
<tr>
<td>M7</td>
<td>Difficult to learn System complexity Unfriendly interface design</td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td>Difficult to learn Inaccuracy of data Unfriendly textual interface Unfriendly screen layout</td>
<td></td>
</tr>
<tr>
<td>M9</td>
<td>Underutilisation of system Difficult to learn</td>
<td></td>
</tr>
<tr>
<td>E10</td>
<td>System complexity Interoperability Issue Difficult to learn Unfriendly interface Complex screen design Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td>S11</td>
<td>System complexity Interoperability issue</td>
<td></td>
</tr>
<tr>
<td>E12</td>
<td>Interoperability issue Difficult to learn Underutilisation of system Unfriendly interface due to unfamiliar technology</td>
<td></td>
</tr>
<tr>
<td>C13</td>
<td>System complexity Difficult to learn System features problem Process exploration</td>
<td></td>
</tr>
<tr>
<td>M14</td>
<td>Technical problem Underutilisation of system Unavailable of customised function Not capable to learn Underutilisation of system Untimeliness of data Poor screen layout</td>
<td></td>
</tr>
<tr>
<td>M15</td>
<td>Network problem (Infrastructure) Untimeliness of the data</td>
<td></td>
</tr>
<tr>
<td>E16</td>
<td>System functionality problem</td>
<td></td>
</tr>
<tr>
<td>E17</td>
<td>Setting problem System complexity</td>
<td></td>
</tr>
<tr>
<td>Participants</td>
<td>Initial Codes (121)</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>M18</td>
<td>System complexity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difficult to learn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td>S19</td>
<td>Poor screen design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Missing information (Incompleteness)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor screen layout</td>
<td></td>
</tr>
<tr>
<td>M20</td>
<td>Untimeliness of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difficult to learn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awkward screen-interface problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable function (report)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccurate data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable customised function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable function (report)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incompleteness of data</td>
<td></td>
</tr>
<tr>
<td>M21</td>
<td>Untimeliness of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Untimeliness of data-process delay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable of customised function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do not like to use and learn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Missing data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unfriendly interface design</td>
<td></td>
</tr>
<tr>
<td>E22</td>
<td>Untimeliness of the data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Underutilisation of function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccurate of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awkward screen layout</td>
<td></td>
</tr>
<tr>
<td>S23</td>
<td>Data is omitted (incompleteness)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Missing input (Incompleteness)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complex system features</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Untimeliness of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccurate of data</td>
<td></td>
</tr>
<tr>
<td>C24</td>
<td>Difficult to learn</td>
<td></td>
</tr>
<tr>
<td>M25</td>
<td>User unfriendliness interface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Untimeliness of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Server slow (infrastructure)</td>
<td></td>
</tr>
<tr>
<td>C26</td>
<td>Difficult to learn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Untimeliness of data</td>
<td></td>
</tr>
<tr>
<td>E27</td>
<td>Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable of function (report)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable of customised function</td>
<td></td>
</tr>
<tr>
<td>E28</td>
<td>System slow-technical problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccuracy of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable of customised function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difficult to understand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccurate data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td>C29</td>
<td>Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boring screen design (unattractive design)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable function (report)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technical infrastructure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccuracy of data</td>
<td></td>
</tr>
<tr>
<td>E30</td>
<td>Underutilisation of system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inaccuracy of data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unavailable function (report)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difficult to use and understand</td>
<td></td>
</tr>
</tbody>
</table>

*Participant Codes_**M = Manager, **E = Executive, **S = Supervisor, **C = Clerk*
**Step 3:** Identifying first level sub-categories from the unique codes during this step, the identified initial codes were grouped to form sub-categories. A category stands for a phenomenon, that is, a problem, an issue, an event or a happening that is defined as being significant to respondents (Schreiber 2001). In total, 11 first level sub-categories were created during this step. For instance, because technical and network issues refer to the underlying network infrastructure that hosts SAP, the open codes of network issue, technical issue and slow server were combined to create a higher level category of technical problem. In another instance, unavailability of function for reporting, analysis, scheduling or notification, unavailability of customised function and unavailability of function were under the umbrella of unavailability of functions. The following table illustrates the generation of sub-categories.

<table>
<thead>
<tr>
<th>Unique Codes (37)</th>
<th>Sub-Category (11)</th>
<th>Definition</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>System complexity</td>
<td><strong>System Complexity</strong></td>
<td>The degree to which SAP is difficult to use</td>
<td>Rogers (1983)</td>
</tr>
<tr>
<td>Complex system features</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interoperability problem</td>
<td><strong>System Non-Interoperability</strong></td>
<td>Lack of ability to interact with one or more specified systems</td>
<td>ISO IEC 9126-1 (ISO/IEC, 1998)</td>
</tr>
<tr>
<td>Unavailable function (analysis)</td>
<td><strong>Unavailable of Functions</strong></td>
<td>Lack of SAP functionality to perform a required task in a timely way (based on ISO EC 9126)</td>
<td>ISO IEC 9126-1 (ISO/IEC, 1998)</td>
</tr>
<tr>
<td>Unavailable function (scheduling)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unavailable function (reporting and storage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unavailable customised function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unavailable function (notification)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unavailable function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult to learn</td>
<td><strong>System Non-Learnability</strong></td>
<td>Lack of SAP system inbuilt capability that enables users to learn how to use it</td>
<td>ISO IEC 9126-1 (ISO/IEC, 1998)</td>
</tr>
<tr>
<td>Not capable to learn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not like to learn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult to understand</td>
<td><strong>System Non-Understandability</strong></td>
<td>The inability of SAP to enable the user to understand whether SAP is suitable, and how it can be used for a particular task and condition</td>
<td>ISO IEC 9126-1 (ISO/IEC, 1998)</td>
</tr>
<tr>
<td>Difficult to use and understand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underutilisation of system</td>
<td><strong>System Underutilisation</strong></td>
<td>SAP features have not been fully exploited by SAP users</td>
<td>Jasperson, Carter &amp; Zmud (2005)</td>
</tr>
<tr>
<td>Inaccuracy of data</td>
<td><strong>Inaccuracy of Data</strong></td>
<td>Mismatch between SAP data and reality elsewhere</td>
<td>Ballou &amp; Pazer (1985)</td>
</tr>
</tbody>
</table>
Step 4: When performing this step, the sub-categories and first level codes were compared with the existing and incoming data. Additionally, the identified categories were then compared with the data and codes based on the open coding process (Strauss & Corbin 1998). Then similar sub-categories were combined to create categories. Overall, from 11 sub-categories, only 6 major categories emerged. Table 4.8 illustrates the identified categories of ERP problems. Once the categories of end user usage problems were established, the researcher then proceeded to describe the properties of each category.
Step 5: Identifying properties and defining dimensions. In line with previous studies, all the initial codes and sub-categories within the same category were compared to eliminate any out-of-extent category and create ‘property’ (Goulding 2002). Properties are the general or specific ‘characteristics or attributes of a category’ (Strauss & Corbin 1998, p. 101). The dimensions, relationship and consequences of each category have the ability to connect to other categories. For example, the property of ‘technical problem’ was defined as the flexibility and speed affecting ERP users, as shown in Table 4.9.

Dimensions represent ‘the ranges along which general properties or category vary, giving specification to a category and variation of theory’ (Strauss & Corbin 1998, p. 101). Table 4.9 depicts the creation of the ERP Problems dimensions. A category is considered saturated when there is no new knowledge to further develop during the analysis (Strauss & Corbin 1998). This implies that no further relevant property, dimension and interactions are produced from the data. For theoretical saturation, the analysis is no longer discovering new

<table>
<thead>
<tr>
<th>Sub Category (11)</th>
<th>Category (6)</th>
<th>Description</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Complexity</td>
<td>System Functionality</td>
<td>The capability of the software to provide functions which meet stated and implied needs when the software is used under specified conditions (what the software does to fulfil needs)</td>
<td>Rogers (1983); ISO IEC 9126-1 (ISO/IEC, 1998)</td>
</tr>
<tr>
<td>System Non-Interoperability</td>
<td>Unavailability of Functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Non-Learnability</td>
<td>System Usability</td>
<td>The capability of the software to be understood, learned, used and attractive to the user, when used under specified conditions (the effort needed for use)</td>
<td>ISO IEC 9126-1 (ISO/IEC, 1998)</td>
</tr>
<tr>
<td>System Non-Understandability</td>
<td>System Utilisation</td>
<td>SAP features have not been fully exploited by SAP users</td>
<td>Jasperson, Carter &amp; Zmud (2005)</td>
</tr>
<tr>
<td>System underutilisation</td>
<td>Data Quality</td>
<td>The measure of the agreement between the data views presented by ERP and that same data in the real world</td>
<td>Park &amp; Kusiak (2005) Ballou &amp; Pazer (1985)</td>
</tr>
<tr>
<td>Poor IT Infrastructure</td>
<td>Technical Infrastructure</td>
<td>Poor interface SAP’s screen design to capture all the necessary information</td>
<td>Singh &amp; Wesson (2009)</td>
</tr>
<tr>
<td>Poor Interface Design</td>
<td>Interface</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.8: The Generated Categories of ERP Problem
findings that spark new theoretical insights, nor is it revealing new properties of the core theoretical categories (Strauss & Corbin 1998).

Table 4.9: Open Coding – Category, Property and Dimension (ERP Problems)

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Property</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Functionality</td>
<td>System complexity</td>
<td>Complexity/Ease of Use</td>
<td>Simple to Complex</td>
</tr>
<tr>
<td></td>
<td>System Non-Interoperability</td>
<td>Interoperability</td>
<td>Connected to Isolated</td>
</tr>
<tr>
<td></td>
<td>Unavailability of Functions</td>
<td>Availability</td>
<td>Any to None</td>
</tr>
<tr>
<td>System Usability</td>
<td>System Non-Learnability</td>
<td>Learnability</td>
<td>Easy to Difficult</td>
</tr>
<tr>
<td></td>
<td>System Non-Understandability</td>
<td>Understandability</td>
<td>High to Low</td>
</tr>
<tr>
<td>System Utilisation</td>
<td>System Underutilisation</td>
<td>Utilisation</td>
<td>Overutilisation to Full Utilisation to Underutilisation</td>
</tr>
<tr>
<td>Data Quality</td>
<td>Untimeliness</td>
<td>Timeliness</td>
<td>Real Time to Delay</td>
</tr>
<tr>
<td></td>
<td>Inaccuracy</td>
<td>Accuracy</td>
<td>Accurate to Inaccurate</td>
</tr>
<tr>
<td></td>
<td>Incompleteness</td>
<td>Completeness</td>
<td>Complete to Incomplete</td>
</tr>
<tr>
<td>Technical</td>
<td>Poor IT Infrastructure</td>
<td>Speed</td>
<td>Fast to Slow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexibility</td>
<td>Fixed to Flexible</td>
</tr>
<tr>
<td>Interface</td>
<td>Poor Interface Screen</td>
<td>Limited Space</td>
<td>Fixed to Limitless</td>
</tr>
<tr>
<td></td>
<td>Design</td>
<td>Attractiveness</td>
<td>Interesting to Boring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>User Friendliness</td>
<td>Simple to Complex</td>
</tr>
</tbody>
</table>

The final results of the open coding are summarised above in Table 4.9. The main categories developed for the end users’ usage problems domain were system functionality, system usability, data quality, technical and interface.

4.6.2.2 Thematic coding

For Research Question 2 (antecedent factors) and Question 3 (coping mechanism), the data were analysed by using a thematic analysis approach. Thematic analysis is one of the predominant techniques used for qualitative data analysis and is the process of searching, identifying and exploring codes and themes based on initial concepts in the description of a phenomenon (Daly, Kellehear & Glikson 1997). The thematic coding used is based on the approach suggested by Boyatzis (1998, p. 4), who suggested three stages in the use of thematic analysis. The first stage involves determining the sampling and design issue. Stage 2 involves developing themes and codes. The final stage involves validating and using the codes.
The first stage was accomplished prior to data collection. To complete the second stage and develop themes, the data from the interviews were organised. A theme is a pattern found in information that describes and interprets aspects of a phenomenon in which the researcher is interested (Boyatzis 1998). The initial conceptual framework served as the original template for identifying themes for the analysis. Such an approach allows the use of existing themes and codes in order to replicate, extend or refute prior discoveries (Boyatzis 1998). The chosen thematic approach was based on Boyatzis’ suggestion on the flexibility it gives to researchers who may not have the training or confidence to develop their own codes and thus depend on existing theories to assist them in developing themes and codes.

The themes were identified from the initial conceptual framework, followed by the emerging themes. On this basis, data from the interview transcripts were organised into eight pre-identified constructs (sub-categories) of antecedent factors to ERP use problem from the initial framework (see Figure 3.1). These constructs are: control, resources, magnitude, individual strength, affordance, system reliability, task interdependence and non-routines. These constructs were in four main categories: organisation, user, technology and task. Then, going through the data, new findings that redefined the initial framework were added. From this process, no new category was added. Some of the initial themes were not supported by the data and hence were removed. These constructs were system reliability, user magnitude and task non-routines.

On the other hand, as the process progressed, new sub-categories (constructs) emerged. The new sub-categories were added, redefined and renamed to reflect the antecedent factors within their respective categories. Thus, for the organisation factors, the category of resources was expanded to include lack of funds, lack of support and lack of training. For the user factors, three new variables – lack of awareness, negative user attitude and learning style preferences – were added. Table 4.10 depicts a snapshot of the Generated Thematic Coding for Antecedent Factors that was generated for Question 2.
In analysing the third research question of the coping mechanisms employed, a similar coding process to that used for Question 2 (the antecedent factors to ERP problems) was applied. Initially, four categories of coping mechanisms were identified (see Section 3.3.3). The identified types of coping mechanisms were: feral information system, feral use of information technology (feral data is part of feral IT), endurance and inaction. From the

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Definition</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORGANISATION</td>
<td>Lack of Funds</td>
<td>The unavailability of money to finance SAP system maintenance and upgrade</td>
<td>Behrens &amp; Sedera (2004, p. 1712)</td>
</tr>
<tr>
<td></td>
<td>Lack of Support</td>
<td>The lack of technical expertise from the support team</td>
<td>Ewusi- Mensah (1997)</td>
</tr>
<tr>
<td></td>
<td>Lack of Control</td>
<td>Lack of coordination activities within a work system that affects the smoothness of operations and disrupts the accomplishment of tasks via SAP</td>
<td>Wäfler et al. (2011, p. 204)</td>
</tr>
<tr>
<td></td>
<td>Inadequate Training</td>
<td>The insufficient amount and quality of specialised instruction and practice that is given to the user to increase the user's proficiency in ERP usage</td>
<td>Wu and Wang (2007, p. 1594)</td>
</tr>
<tr>
<td>USER</td>
<td>Lack of Individual Strength</td>
<td>Level of conviction about the judgment and confidence of users with regard to their ability to carry out the tasks by using SAP</td>
<td>Compeau &amp; Higgins (1995)</td>
</tr>
<tr>
<td></td>
<td>Lack of Awareness</td>
<td>Lack of a SAP user’s attentiveness to how their tasks will be completed by using SAP</td>
<td>Gutwin et al. (1995)</td>
</tr>
<tr>
<td></td>
<td>Learning Styles Preferences</td>
<td>The manner in which different elements from five basic stimuli affect an individual’s ability to perceive, interact with and respond to the learning environment</td>
<td>Dunn, Beaudry &amp; Klavas (1989)</td>
</tr>
<tr>
<td></td>
<td>Negative Attitude</td>
<td>User predisposition to respond unfavourably to system use</td>
<td>Ajzen (1988)</td>
</tr>
<tr>
<td>TECHNOLOGY</td>
<td>Lack of Technology Affordance</td>
<td>The functions and operations that are provided by SAP</td>
<td>Behrens &amp; Sedera (2004, p. 1720)</td>
</tr>
<tr>
<td>TASK</td>
<td>Task Interdependence</td>
<td>The degree to which individuals interact and depend upon others to accomplish their work via ERP system</td>
<td>Campion, Medsker &amp; Higgs (1993, p. 827)</td>
</tr>
</tbody>
</table>
findings analysis, a new sub-category, Bypass, was found and added. Consequently, the endurance and inaction categories were combined into one as ignore problem /disregard.

4.7 SUMMARY OF THE CHAPTER

This chapter started with the description of the research philosophy and paradigm implemented in this study. The philosophy which underpinned this research is soft positivism. On this basis, a qualitative method employing a multiple case study research design was appropriate to capture the end user ERP problems, antecedent factors and coping mechanisms, and their complex relationships.

The in-depth interviews were conducted with two subsidiaries of PETRONAS, a multinational oil and gas industry in Malaysia, and an automotive component manufacturer. In the main study, data collection involved face-to-face interviews and reviewing the documents belonging to the three cases. These companies were identified as cases A, B and C. Then the researcher discussed the method of data analysis, which involved a combination of open and thematic coding.

Up to this point, the thesis has presented the research problems, the literature review, the exploratory study, and the initial conceptual research design and methodology. In the following chapter, the case study findings are presented on the end user ERP problems, the antecedents to the problems and coping mechanisms. The Case Study Reports are organised into three main sections: Case Study 1 reports the findings for Case A, and Case Studies 2 and 3 report the findings for Cases B and C respectively.
5.1 INTRODUCTION

This chapter presents the findings from each of the three case studies in terms of: (a) users’ experiences with the ERP system including problems and issues encountered by them, (b) the factors that caused these problems and (c) the coping mechanisms employed to overcome such problems.

Following this introduction, this chapter has three sections. Section 5.2 describes Case A’s general background profile (5.2.1) and its IT and ERP system background (5.2.2). This is followed by the findings of the ERP system usage problems (5.2.3), the causes of the problems (5.2.4), coping mechanisms (5.2.5), and summary and conclusion (5.2.6). The next section (5.3) illustrates Case B using a similar structure as that for Case A, and this also applies to Case C in section 5.4.
5.2 CASE STUDY 1: CASE A

5.2.1 Background Profile of Case A

Case A is a wholly owned subsidiary of PATRON BERHAD (a pseudonym). PATRON BERHAD was incorporated on 17 August 1974 to develop and add value to Malaysia’s oil and gas supplies. PATRON BERHAD operates in more than 20 countries and owns over 100 subsidiaries and associated companies. Case A was incorporated on 23 July 1997 and is located at PATRON Industry Complex (PPIC). The company has 196 personnel comprising 70 executives, 112 non-executives and 14 expatriates. The company’s revenue as of April 2011 was AUD 49.859 million (RM 146.088 million).

The principal activities of Case A are the production and selling of ammonia, syngas and carbon monoxide. Case A is a major producer of ammonia and is also known as the most preferred ammonia and syngas producer in Asia (Malaysian Petrochemicals Association 2007). Case A started ammonia production in December 2000. Currently, the plant’s daily production capacities are 740 MT of carbon monoxide, 273 MT of Oxogas and 1380 MT of ammonia. Case A’s organisational chart is depicted in Figure 5.1. Interviews were conducted with staff members and managers of six departments, from which there were thirteen respondents in total. Table 5.1 shows the data sources for Case A.

Figure 5.1: CASE A’s ORGANISATION CHART

Source: Organisation Chart of Case A
Table 5.1: Summary of Data Sources of Case A

<table>
<thead>
<tr>
<th>Name of Document</th>
<th>Doc’s Codes</th>
<th>Interviewees’ Job Titles</th>
<th>Interviewees’ Codes</th>
<th>Department</th>
<th>Job Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case A Annual Report 2010/2011</td>
<td>DA1</td>
<td>Senior Manager</td>
<td>M1</td>
<td>Engineering and Services</td>
<td>Managing ESD by delivering support services to Plant Operations and ensuring that the plant equipment is well maintained and running at full capacity</td>
</tr>
<tr>
<td>Corporate Profile 2009</td>
<td>DA2</td>
<td>Executive</td>
<td>E2</td>
<td>Engineering and Services</td>
<td>Managing the PATRON’s Maintenance Management System, to oversee and coordinate day-to-day work planning, shutdown and turnaround</td>
</tr>
<tr>
<td>Case A Entrance Pack</td>
<td>DA3</td>
<td>Executive</td>
<td>E3</td>
<td>Engineering and Services</td>
<td>Plan and monitor maintenance and scheduling jobs for the plant</td>
</tr>
<tr>
<td>Organisation Chart of Case A (2010/2011)</td>
<td>DA4</td>
<td>Manager</td>
<td>M4</td>
<td>Operating Performance and Improvement</td>
<td>Manage the Business Process Improvement section and Change Management (managing the quality of systems and human factors)</td>
</tr>
<tr>
<td>Case A SCM 5 years Plan</td>
<td>DA5</td>
<td>Executive</td>
<td>E5</td>
<td>Operating Performance and Improvement</td>
<td>Monitor and coordinate all related online systems (also the ‘focal person’ for internal IT matters)</td>
</tr>
<tr>
<td>Case A HSE FY2011</td>
<td>DA6</td>
<td>Clerk</td>
<td>C6</td>
<td>Operating Performance and Improvement</td>
<td>Preparing the ISO documentation and accountable for allocating and maintaining physical infrastructure and workstations for new employees</td>
</tr>
<tr>
<td>Name of Document</td>
<td>Doc’s Codes</td>
<td>Interviewees’ Job Titles</td>
<td>Interviewees’ Codes</td>
<td>Department</td>
<td>Job Scope</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>Case A Business Plan 2010/2011</td>
<td>DA7</td>
<td>Manager</td>
<td>M7</td>
<td>Plant Operations</td>
<td>Manage the Plant Operations departments and manage and oversee problems associated with the equipment’s maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Executive</td>
<td>E8</td>
<td>Plant Operations</td>
<td>Responsible for the plant equipment and daily care activities (other than plant operations), and the logistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manager</td>
<td>M9</td>
<td>Technical Services</td>
<td>Manage process engineering section under technical services department, manage and oversee overall plant improvement process, process technology improvement, cost-saving initiative and business growth opportunities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supervisor</td>
<td>S11</td>
<td>Human Resource Management and Administration</td>
<td>Supervising the preparation of staff remuneration (emoluments) and benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Executive</td>
<td>E12</td>
<td>Finance and Planning</td>
<td>Coordinating and preparing a set of financial statements, reviewing the posting of accounts into the SAP system, monitoring the budget and allocation to the cost centre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clerk</td>
<td>C13</td>
<td>Finance and Planning</td>
<td>Preparation of General Ledger, maintaining the bank balance, providing the assets numbers to the SAP system user</td>
</tr>
</tbody>
</table>
5.2.2 IT Department and ERP System in Case A

Case A has had its own internal IT department that used to manage all the information systems and any IT-related issues. In 2005, Case A replaced its internal IT Department services with a third party vendor called iPerintis. Since then, iPerintis has managed Case A’s IT infrastructure and has provided support for all of the information systems deployed in Case A as well as in all of the other subsidiaries of PATRON BHD. Even though iPerintis is responsible for managing the information systems in Case A, the parent company (PATRON) still requires its wholly-owned subsidiaries to assign a focal person to coordinate IT activities internally. This is the responsibility of the executive (E5) working in the Operating Performance and Improvement Department (OPI). Apart from iPerintis, Case A also has a functional relationship with the Corporate Information Development Unit (CIDU) of PATRON BHD.

The ERP system that Case A has implemented is SAP (Systems Application and Products in Data Processing), which has been used since Case A’s incorporation in 1997. In 2000, Case A embarked on a major revamp of its early SAP version. Table 5.2 provides a summary of the general background and the IT and ERP system background of Case A. In the subsequent section, the findings of issues and problems encountered by SAP users are presented with reference to Case A.

Table 5.2: Summary Profile of Case A

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Background</td>
<td></td>
</tr>
<tr>
<td>Industry Sector</td>
<td>Industrial Gases</td>
</tr>
<tr>
<td>Business Segments</td>
<td>Petrochemical</td>
</tr>
<tr>
<td>Incorporation</td>
<td>23 July 1997</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>196</td>
</tr>
<tr>
<td>Core Products</td>
<td>Production and Sale of Ammonia</td>
</tr>
<tr>
<td>Additional Products</td>
<td>Carbon Monoxide, Oxogas</td>
</tr>
<tr>
<td>Revenue as of 2011</td>
<td>RM146.088 million (April–May 2011)</td>
</tr>
<tr>
<td>IT and ERP</td>
<td></td>
</tr>
<tr>
<td>Number of employees in the IT Department</td>
<td>None (the IT department was outsourced to a third party vendor, iPerintis)</td>
</tr>
<tr>
<td>Type of ERP System</td>
<td>SAP   R/3</td>
</tr>
<tr>
<td>Implementation (Go Live) Date</td>
<td>July 1997</td>
</tr>
<tr>
<td>Modules implemented</td>
<td>- Financial Information and Controlling (FI &amp; CO) Modules</td>
</tr>
<tr>
<td></td>
<td>- Material Management Module (Triple M)</td>
</tr>
<tr>
<td></td>
<td>- Plant and Maintenance Module (PM)</td>
</tr>
<tr>
<td></td>
<td>- Human Resource Integrated System Module (HRIS)</td>
</tr>
</tbody>
</table>
### IT and ERP

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upgrade History</strong></td>
<td>Introduction of SAP R/2 at Case A. Upgraded to SAP R/3 in 2000</td>
</tr>
<tr>
<td><strong>Reason for SAP Upgrade</strong></td>
<td>Why upgrade from SAP R/2 to SAP R/3</td>
</tr>
<tr>
<td></td>
<td>Problems associated with poor analysis features in SAP R/2</td>
</tr>
<tr>
<td></td>
<td>Time-consuming in generating reports</td>
</tr>
<tr>
<td></td>
<td>Preparation for Y2K</td>
</tr>
<tr>
<td></td>
<td>SAP R/2 was not user friendly and required memorising all the</td>
</tr>
<tr>
<td></td>
<td>transaction codes</td>
</tr>
<tr>
<td></td>
<td>Slow in terms of response time</td>
</tr>
<tr>
<td></td>
<td>Limited scope of usage</td>
</tr>
<tr>
<td><strong>Current situation of ERP use</strong></td>
<td>SAP mainly used for operational tasks</td>
</tr>
<tr>
<td></td>
<td>Only 60%-80% of the implemented system capacity exploited</td>
</tr>
<tr>
<td></td>
<td>Underutilisation of implemented modules</td>
</tr>
<tr>
<td><strong>Major Benefits</strong></td>
<td>Proper recording and retrieval of data for further analysis</td>
</tr>
<tr>
<td></td>
<td>Ease in monitoring equipment history</td>
</tr>
<tr>
<td></td>
<td>Expedite the job/process – interpreting data, speed up work,</td>
</tr>
<tr>
<td></td>
<td>managing day-to-day work</td>
</tr>
<tr>
<td></td>
<td>Standardisation and centralising of maintenance process</td>
</tr>
</tbody>
</table>

*Source: Compiled from Annual Report for 2009/2010 (DA1) and Interview Sources for Case A*

### 5.2.3 Problems and Issues in the ERP System Use

The findings describe the major problems that emerged from the interview transcripts and the perusal of relevant documentation for Case A. The open coding approach and data analysis technique (Strauss & Corbin 1998) was used to analyse the interview transcripts, as discussed in Section 4.5.2, Research Methodology. The analysis identified systems, data and interfaces as the three main problem areas. The analysis also resulted in the generation of a number of sub-categories in each of the three main problem areas. Table 5.3 illustrates a summary of the definitions of the problem dimensions in each of the categories and sub-categories as well as interview logs, which are discussed in the ensuing sections.
Table 5.3: SAP Use Problems and Issues in Case A

<table>
<thead>
<tr>
<th>Category</th>
<th>Dimension/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Functionality</td>
<td><strong>Complexity:</strong> the degree to which SAP is difficult to use (based on Rogers, 1983)</td>
<td>SAP is very rigid. I do not know how they programmed it. Initially, we wanted to use many of the features from the system. Nevertheless, some of the features are not friendly enough to be used. [Human Resource Management Administration Executive - E10]</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Unavailability:</strong> lack of SAP functionality to perform a required task in a timely way (based on ISO EC 9126)</td>
<td>SAP is considered very helpful, but not for the analysis part. We have a history of all the completed repair jobs, but we are still unable to generate a summarised analysis from SAP. For instance, we are not able to get the analysis of the MTBF (Mean Time Between Failures) from SAP. This analysis is important for us to know the performances of the equipments. [Engineering and Services Executive - E2]; [Engineering and Services Senior Manager - M1]</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>Non-Interoperability:</strong> lack of ability to interact with one or more specified systems (based on ISO EC 9126)</td>
<td>One of the problems that we have at the moment is that SAP is not an ‘open’ system. For example, take the Intergraph system for document management. Intergraph system is used to manage projects. For this system (Intergraph) to do wonders, it needs to be fed with data. In our case, most of the data is derived from SAP, but unfortunately the link into SAP is not there yet. [Engineering and Services Executive - E2]; [Engineering and Services Senior Manager - M1]</td>
<td>7</td>
</tr>
<tr>
<td>System Usability</td>
<td><strong>Non-Learnability:</strong> The lack of SAP system inbuilt capability that enables users to learn how to use it (Based on ISO/IEC 9126)</td>
<td>I have to refer back to training material because this system is quite comprehensive; I would say that it is slightly complicated for the users. [Plant Operation Manager - M7]</td>
<td>7</td>
</tr>
<tr>
<td>System Utilisation</td>
<td><strong>Underutilisation</strong> SAP features have not been fully exploited by SAP users (Jasperson, Carter &amp; Zmud 2005)</td>
<td>For a large Operating Performance Unit (OPU), they are using most of the modules and functions in HRIS (Human Resource Information System). However, since we are only a small OPU, we are using about 60% of the HRIS. [Human Resource Management Administration Executive - E10]</td>
<td>7</td>
</tr>
<tr>
<td>Data</td>
<td><strong>Inaccuracy:</strong> Mismatch between SAP data and reality elsewhere (based on Ballou &amp; Pazer 1985)</td>
<td>One thing lacking in SAP at the moment is the calculation of MTBF (Mean Time Between Failures). This is because SAP cannot generate accurate data to assign the related MTBF for specific equipment. We are facing problems in tracking down the interval time of the equipment failures through SAP due to inaccuracy of data in the system. [Engineering and Services Executive - E3]</td>
<td>7</td>
</tr>
</tbody>
</table>
5.2.3.1 System Problems

In Case A, interviewees have generally found SAP to be overly complex, non-interoperable and hard to learn. Some functions are not available and others are underutilised. Many types of system complexity problems were identified in the Human Resource Management and Administration (HRMA), and Operating Performance and Improvement (OPI) departments. In the HRMA Department, according to its executive and supervisor, SAP is considered to be a rigid and difficult system to master. Therefore, some users are discouraged from fully exploring its functionalities, which leads to underutilisation. The interviewees from HRMA estimate that 60% of the existing functionalities included in ERP are used by employees of Case A. According to both the HRMA supervisor and an executive from the OPI department, SAP is too complex for novice users. In the Operating Performance and Improvement Department, the SAP system was viewed as a complex system, particularly by the novice users. Table 5.4 suggests some examples of SAP complexity issues found in Case A.

<table>
<thead>
<tr>
<th>Category</th>
<th>Dimension/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>SAP’s screen has not been designed in an attractive way for SAP users</td>
<td>The SAP interface is not user friendly. All the icons and buttons are on the top. Therefore, we need to click one-step and open the next page and do it again. It has too many screens, too many steps to get to what you want. Sometimes I got bored. If you login to the system, you need to know what to do next and which category needs to be found…. From my observation of colleagues who are using SAP, they have their own notebooks to write all the steps on doing certain processes. If you skip one of the steps, it will create a problem later. [Operating Performance and Improvement Executive - E5]</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 5.4: Examples of SAP Complexity Problems in Case A

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resource Management and Administration (HRMA)</td>
<td>SAP is too complex to be fully explored</td>
<td>SAP Itself is very rigid. I do not know how they program the system. Initially, we wanted to explore and use many of the features in the system. Nevertheless, some of the features are not friendly enough to be used. [Human Resource Management Administration Executive - E10]</td>
</tr>
<tr>
<td>Human Resource Management and Administration (HRMA)</td>
<td>SAP is a complex system when implemented in an organisation without any or with limited IT experience</td>
<td>At the initial stage, like myself, I feel this system is burdensome. That was at the end of the 1980s, where I just started to use it. At this time, SAP was just being introduced to PATRON BHD. Usually, we use manual methods but with SAP, there are a lot of things that need to be updated. That is why I said it is burdensome. [Human Resource Management Administration Supervisor - S11]</td>
</tr>
<tr>
<td>Operating Performance and Improvement (OPI)</td>
<td>SAP is particularly complex for novice users</td>
<td>For the new user, it is quite difficult to use SAP because there are quite a lot of buttons and steps that they need to do before getting what they want. [Operating Performance and Improvement Executive department - E5]</td>
</tr>
<tr>
<td>Finance and Planning (FP)</td>
<td>The complexity problem as experienced by novice users</td>
<td>SAP is such a complex system. For some of us, it is so upsetting when being told to get a ERP GUI, logon password and execute a specific transaction using ERP. I have experienced this before and I believe most of the new staff will feel the same thing. [Finance and Planning Clerk - C13]</td>
</tr>
<tr>
<td>Operating Performance and Improvement (OPI)</td>
<td>The complexity issue effect the other related work processes</td>
<td>Even until now, I was still anxious to use the ERP system because it is so complicated. I have to be liable for my action as others’ work might be affected by my action if I make some mistakes. [Operating Performance and Improvement Clerk - C6]</td>
</tr>
</tbody>
</table>

Interviewees from the Engineering and Service, Finance and Planning, and Operating Performance and Improvement departments also reported that SAP lacks some functionalities that are essential to their tasks. Examples include: (a) planning for the turnaround and shutdown process, (b) analysis and reporting of maintenance and (c) automatic email notification of the status of purchase requisitions (see Table 5.5 for details).

In the Engineering and Services Department (ESD), the complexity of using SAP is exhibited during the turnaround and shutdown process. Turnaround is a major shutdown of the plant that is carried out every three to five years. This turnaround process is intended to troubleshoot all equipment problems and to ensure that equipment performs efficiently in the future. Unlike a normal shutdown, this turnaround shutdown requires many resources such as materials, power and contractors. Users find the SAP system to be quite complex for...
planning and scheduling the turnaround process and other maintenance jobs and instead use either PRIMAVERA or Microsoft Project.

The disadvantage of using alternative systems is that the planning data are not automatically updated into SAP, which leads to data inaccuracy. One of the executives from the Engineering and Services Department (E3) believed that eventually the problems would be fixed by integrating the PRIMAVERA and SAP systems: ‘Even if we are using other systems such as Microsoft Project or PRIMAVERA, we want SAP to automatically integrate the scheduling functions.’ However, the resources required to do so are scarce. Table 5.4 catalogues the complexity problems encountered in various departments of Case A.

In terms of analysis and reporting of maintenance jobs, SAP cannot adequately generate a maintenance job summary (for equipment) in the Engineering and Services Department. Because of this particular shortcoming, users such as the executive of the ESD (E2) revert to Microsoft Excel to analyse and report on maintenance jobs at weekly maintenance meetings. In addition, due to the lack of automatic email notification within SAP, an executive from the Operating Performance and Improvement Department cannot easily determine the status of purchase requisitions unless he or she logs into SAP. This situation worsens since the majority of end users in this department are not stationed at one place, so they need to always keep track of the status of purchase requisitions raised by them; this is considered burdensome to them.

**Table 5.5: Examples of SAP Functional Unavailability Problems in Case A**

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering and Services Department</td>
<td>Microsoft Project is used for the shutdown phase due to the unavailability of customised scheduling for the maintenance job in SAP</td>
<td><em>For example, scheduling of a project that has to be done outside the SAP system is done by using Microsoft Project. This software is used to plan the work but to schedule it; we need to use Microsoft Project. I would like to give an example. If we had to ‘shut down’ our plant for 7 days and during that period, we want to execute 100 maintenance jobs within 5 days, how are we going to plan for the job within this period of time? Due to the unavailability of customised functionality of SAP system, we use a scheduling program like Microsoft Project to schedule the 100 jobs into 5 days.</em>  [Engineering and Services Executive - E2]</td>
</tr>
<tr>
<td>Engineering and Services Department</td>
<td>SAP is not able to provide scheduling functionalities</td>
<td><em>One of the SAP problems is in terms of the scheduling function, as we could not find that function in the system. Therefore, users need to use Microsoft Excel.</em>  [Engineering and Services Executive - E3]</td>
</tr>
<tr>
<td>Where</td>
<td>What</td>
<td>Interview logs</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>----------------</td>
</tr>
<tr>
<td>Engineering and Services Department</td>
<td>There are no SAP function for summarising maintenance jobs</td>
<td>SAP is considered very helpful, but not for the analysis part. We have a history of all the completed repair jobs, but we are still unable to generate a summarised analysis from SAP. For instance, we are not able to get the analysis of the MTBF (Mean Time between Failures) from SAP. This analysis is important for us to know the performances of the equipments. [Engineering and Services Executive - E2]</td>
</tr>
<tr>
<td>Engineering and Services Department</td>
<td>Supplementary information required for the maintenance job is not made available to SAP users and has not been customised to their requirements</td>
<td>We have extra information, for example, for the preparation of the job where we need to put in additional information in SAP. Somehow, the function is not available in the system. This is because we require more and SAP does not provide such a function. [Engineering and Services Executive - E2]</td>
</tr>
<tr>
<td>Operating Performance and Improvement Department (OPI)</td>
<td>Email notification is not available in SAP, leading to not knowing the status of transactions, especially when SAP users are mobile and require such functionalities.</td>
<td>Another problem is on the notification. For example, for our online systems (other systems besides SAP), every step that we do and require our manager’s approval; we can configure it through the email sent by various parties. Say, when I raise Purchase Requisition that needs my boss’s approval, if we do it outside SAP, the email notification is sent to my boss to inform that ‘there is a request that needs your approval or endorsement’, so he or she will give the approval. So far, we do not see that function in SAP. [Operating Performance Improvement Executive - E5]</td>
</tr>
</tbody>
</table>

The **Non-Interoperability** issue is another problem raised by SAP users in case A. For example, Intergraph is a system purchased by PATRON BHD. This system was intended for designing plant. It is equipped with an advanced design tool application for 3D models, intelligent P90, instrument data sheet, instrument specification and electronic drawing. In fact, any information needed for an installed plant could be provided by the Intergraph system. However, the Intergraph system operates as a stand-alone system without being integrated into the SAP system. For the Intergraph system to work efficiently, the system must be fed with SAP data. Because SAP is not inter-operable with Intergraph, most of the data are downloaded from SAP.

Further, the executive of HRMA (E10) suggested that SAP is unable to interact with the other systems that they use to process management movement, coaching and training activities. She stated, ‘I do not know how they program the system. It is a good data dumping program but not user friendly. What I mean is that there is no interaction with the other in-house
systems. If you want to link between two systems, you need to create another database. That is why we have so many databases.' Her colleague who works as a supervisor in the same department (S11) agreed: 'Though there are many online systems in Case A, but as SAP system is not an interactive one, it is not intended to integrate with these online systems.'

One of the reasons that the SAP users experienced the non-interoperability problem is due to the different platforms and programming languages used by SAP and other online systems, as indicated by an executive of the Operating Performance and Improvement Department (E5): 'Another thing with SAP is that it's quite difficult to do the integration between our current systems. Each of our online systems is on a different platform, different function, and different script so-called language of programming of systems. So, that is why we have several applications beside SAP.'

There are also reported problems of intra-SAP integration. In the words of an executive of the FP department (E12): 'The challenge with the system is on the integration point. Because SAP has many modules, though they are integrated, of course you need to manage the integration point. For example, there would be inconsistency of General Ledger with the sub-ledger. There are a number of times when the General Ledger is not matched with the sub-ledger.'

Some of the SAP users interviewed in Case A also reported that SAP is not an easily learnable system (see Table 5.6). In the Plant and Operation Department, a manager (M7) indicated that most users rely on the SAP manual for guidance because the system is quite complicated for users to learn and master easily. In the Finance and Planning Department, an executive (E12) and a clerk (C13) reported difficulties in learning to close the monthly project balances. Furthermore, an executive from the Human Resource Management and Administration Department (HRMA) (E10) usually refers to other OPU officers for tagging people in the system.

There is also reported underutilisation of the SAP system in Case A compared to other large operating units. While most of the interviewees estimated that only about 60% to 80% of the SAP system functionalities are exploited, a number of participants even suggested that less than 50% of the SAP capacity is being exploited. Table 5.6 highlights examples of the interview logs to illustrate the system underutilisation problems.
### Table 5.6: Examples of System Usability and Underutilisation Problems in Case A

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant Operation Department (PO)</strong></td>
<td>Users have to frequently refer to the SAP material tools since the system is too complex and difficult to learn.</td>
<td>I have to refer back to the training material because this system is quite comprehensive. I would say that it is slightly complicated to use and learn. [Plant Operations Manager - M7]</td>
</tr>
<tr>
<td><strong>Finance and Planning Department (FP)</strong></td>
<td>Closing the end-of-month balances is stressful due to difficulty in learning the SAP system functions.</td>
<td>For example, when I did the end-of-month closing, I was unable to close some of the project balances that I had created earlier. This is because the same figures keep on reappearing. [Finance and Planning Clerk - C13]</td>
</tr>
<tr>
<td><strong>Human Resource Management and Administration Department (HRMA)</strong></td>
<td>Some of the end users experience difficulty in learning the SAP system and had to call other subsidiaries to complete simple processes.</td>
<td>For example, last time when we needed to tag a person, we did not know how to do it, so we needed to call people from other OPUs and asked them how to do it. [Human Resource Management Administration Executive - E10]</td>
</tr>
<tr>
<td><strong>Plant Operations Department (PO)</strong></td>
<td>The difficulty in learning SAP that originates from SAP system complexity forces users to rely on the training material.</td>
<td>Since this system is quite comprehensive, and complicated for normal users, I have to refer to the training materials. I believe that in using SAP, we need to have a certain level of understanding or skill and that is still lacking. [Plant Operations Manager - M7]</td>
</tr>
<tr>
<td><strong>Human Resource Management and Administration Department (HRMA)</strong></td>
<td>The size of Case A led to underutilisation of SAP.</td>
<td>For a large Operating Performance Unit (OPU), they are using most of the modules and also functions in HRIS (Human Resource Information System/SAP). However, since we are only a small OPU, we are using about 60% of HRIS. [Human Resource Management Administration Executive - E10]</td>
</tr>
<tr>
<td><strong>Finance and Planning Department (FP)</strong></td>
<td>The functionalities of SAP are yet to be fully exploited.</td>
<td>There are many functionalities of SAP system but, we have not exploited it yet. Since we are only a small OPU, we are engaged with a small project. Hence, our SAP functionalities are quite restricted as compared to the rest of the PATRON subsidiaries. For some of the larger OPUs like PATRON CariGali Berhad, they are using more SAP functionalities. [Finance and Planning Executive - E12]</td>
</tr>
<tr>
<td><strong>Engineering and Services Department (ESD)</strong></td>
<td>The functionalities of SAP are yet to be fully exploited.</td>
<td>I could say that only 80% of the SAP capacity is being employed. We are still not fully utilising the reporting and document storage capability. [Engineering and Services Executive - E2]</td>
</tr>
<tr>
<td><strong>Technical and Services Department (TES)</strong></td>
<td>The current utilisation of SAP is less than 30%. Our problem is that we are not really utilising and optimising SAP.</td>
<td>The current utilisation of SAP is less than 30%. Our problem is that we are not really utilising and optimising SAP. [Technical and Services Manager - M9]</td>
</tr>
<tr>
<td><strong>Operating Performance and Improvement</strong></td>
<td>We have some limitations in using SAP functionalities. For Case A, only certain functions are available to users, probably less than 50% of the total SAP functionalities. We do not really know because for the past 8 or 9 years, we are only exposed to certain scope of usage only.</td>
<td>We have some limitations in using SAP functionalities. For Case A, only certain functions are available to users, probably less than 50% of the total SAP functionalities. We do not really know because for the past 8 or 9 years, we are only exposed to certain scope of usage only. [Operating Performance Improvement Executive - E5]</td>
</tr>
</tbody>
</table>
5.2.3.2 Data quality problems

Related to data, inaccuracy is a major problem reported in Case A (see Table 5.7 for data inaccuracy logs). For example, in the Engineering and Services Department, inaccuracy of data occurs during the calculation of Mean Time between Failures (MTBF) for equipment and in establishing the cause (signified by a code) for equipment failures. The MTBF is used to predict how well each piece of equipment would function. Each item of equipment has its own estimated life. If equipment is repaired several times over its estimated life, the MTBF indicates how well it will function. Higher MTBF indicates higher reliability.

However, one of the executives (E3) pointed out that some users have employed incorrect codes while recording the origins of machinery-related problems. When there are breakdowns in the plant’s equipment, the maintenance personnel need to determine what caused the problem. If the SAP users have doubts regarding which code to utilise, their current practice is to enter a generic code for equipment failure or fault. However, the selected code does not show the equipment’s real problem. As a result, any report on the analysis of a plant problem and MTBF is not accurate and does not reflect the actual state of the equipment. Using SAP, the tracking of time intervals for equipment failures is not always correct.

Table 5.7: Examples of Data Inaccuracy Problems in Case A

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering and Services Department (ESD)</td>
<td>The inaccuracy of SAP data impacted on the misleading calculation of the interval time for equipment failures (mean time between failures)</td>
<td>One thing lacking in SAP at the moment is the calculation of MTBF (Mean Time between Failures). This is because SAP cannot generate accurate data to assign the related MTBF for the specific equipment. We are facing some problems in tracking down the interval time of equipment failures through SAP due to inaccuracy of data from the system.  [Engineering and Services Executive - E3]</td>
</tr>
<tr>
<td>Operating Performance and Improvement Department (OPI)</td>
<td>SAP data often reflect incorrect cause codes for equipment failure</td>
<td>One example is where the maintenance unit encountered problems with a leaking pipe. They have to enter the cause of the problem in the system, but sometimes they could not find the correct cause code, so they just key in any available code. [Operating Performance Improvement Manager - M4]</td>
</tr>
<tr>
<td>Engineering and Services Department</td>
<td>The incorrect data entry for the cause code of the equipment failure by the technician of ESD resulted in inaccurate SAP data</td>
<td>When we wanted to extract the SAP data for further analysis, it is no longer accurate since the wrong cause code is being used. [Engineering and Services Executive - E3]</td>
</tr>
</tbody>
</table>
5.2.3.3 Interface problems

Users in various departments of Case A found the SAP interface difficult to learn and use. Poor SAP screen design affected employees in the Operating Performance and Improvement, Plants and Operations, Finance and Planning, and Human Resource Management and Administration departments (see Table 5.8). Based on the comments documented in Table 5.8, most end users believed that the poor interface design forces them to go through different but irrelevant screens and steps, discourages them from operating the system properly and drives some users to use alternative software.

Some interviewees commented on the unfamiliar terminology and jargon used in SAP. This is especially evident in the preparation of Purchase Requisitions (PR). For users who are less knowledgeable in the technicalities of SAP, understanding the system’s terminology is a major hurdle. While some participants highlighted the interface issue in terms of the conventional SAP screen design, others suggested an interactive menu that can guide users to the relevant screen faster. In addition, the uniform colour tone of the SAP screen display is perceived by some of the end users as drearily laid out. A number of participants also stressed the textual and taxing interface design that is not favoured by the new generation of IT users. Table 5.8 summarises examples of interviewees’ remarks concerning the interface issues of SAP.

Table 5.8: Examples of Interface Problems in Case A

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Performance and Improvement</td>
<td>The user-unfriendliness of the SAP interface design forces users to</td>
<td>The SAP interface is not user friendly. All the icons and buttons are on the top. Therefore, we need to click one-step and open the next page and do it again. It has many screens, too many steps to get to what you want. Sometimes I get bored. If you login to the system, you need to know what to do next and which category needs to be found. From my observations of colleagues who are using SAP, they have their own notebooks to write all the steps on doing certain processes. If you skip one of the steps, it will create a problem later. [Operating Performance Improvement Executive - E5]</td>
</tr>
<tr>
<td>Department (OPI)</td>
<td>go through various unexciting screen layouts to accomplish their tasks</td>
<td></td>
</tr>
<tr>
<td>Plant and Operations Department</td>
<td>SAP interface design forces users to memorise all the required steps</td>
<td>I think SAP's interface needs to be more user-friendly. In terms of the current interface, I could say that it is quite complicated. Users need to really know and be sure of all of the steps and only then they can go through it. If we have more user-friendly interface or prompt, it would be a better guidance for a novice user. [Plant and Operations Manager - M7]</td>
</tr>
<tr>
<td></td>
<td>when executing business processes</td>
<td></td>
</tr>
<tr>
<td>Where</td>
<td>What</td>
<td>Interview Logs</td>
</tr>
<tr>
<td>--------------------------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Engineering and Services Department</td>
<td>Because of poor interface, users do not store documents in SAP's Document Management Storage (DMS); instead, they opted for Case A's own in-house server</td>
<td>One issue related to SAP is storage of documentation. For example in SAP, we have this function called Document Management Storage (DMS) to store all the information of the plant drawings, specification of maintenance and final jobs, final job reports and others. However, the interface of DMS is not user friendly and it is too complicated. That is why we are using our own server for the document storage. [Engineering and Services Executive - E2]</td>
</tr>
<tr>
<td>Human Resources Management and Administration Department (HRMA)</td>
<td>The unfriendly interface of the SAP resulted in system being perceived as inflexible</td>
<td>If you ask me, there are still a lot of room for improvement. This is because SAP system is not user-friendly. It is too rigid. [Human Resources Management Administration Executive - E10]</td>
</tr>
<tr>
<td>Finance and Planning Department (FP)</td>
<td>SAP Interface uses unfamiliar terminology that adds to its unfriendliness</td>
<td>In approving the purchase request, we cannot just simply select the function. There are many levels of entry and screens we have to go through that are not helpful at all. There is a lot of jargon that I think is not useful. For the technical people, maybe they can appreciate it, but not for the end user. [Finance and Planning Executive - E12]</td>
</tr>
<tr>
<td>Plant Operations Department (PO)</td>
<td>The conventional interface of SAP design is an old-fashioned screen layout that fails to offer an interactive pop-up menu</td>
<td>SAP itself as I already mentioned to you earlier, the interface is like a conventional window in the old days. Even now the window interface is much more user-friendly. Such as you can click the help button to guide you or the 'pop up' message will lead you through all the processes in window but not for SAP. [Plant Operations Executive - E8]</td>
</tr>
<tr>
<td>Human Resource Management and Administration Department (HRMA)</td>
<td>The textual interface of the SAP screen design is not favoured by the new generation of SAP users</td>
<td>I think the new generation prefer the friendlier monograph in SAP. This is because the SAP’s screen layout currently uses text (words). So, if we can have more interactive icons rather than words, it would become more user-friendly. [Human Resource Management Administration Supervisor - S11]</td>
</tr>
<tr>
<td>Human Resource Management and Administration Department (HRMA)</td>
<td>The complex SAP screen design for HRIS complicates workers’ use of the module as they need to have prerequisite knowledge of how the specific menu works</td>
<td>The design screen of HRIS is so taxing and a bit jumbled up. What I personally feel is that if the screen is simpler, it is easier for us to use. If you are using one specific menu, then you need to know what it is, where to find it, meaning that you have to go through one by one. Say for example the manpower development, what is under manpower development since other people may interpret it differently? [Human Resource Management Administration Executive - E10]</td>
</tr>
<tr>
<td>Plant Operations Department</td>
<td>The layout of SAP requires many steps to accomplish tasks</td>
<td>I think the layout can be improved because sometimes SAP is quite confusing, especially for new users. They need to be familiar with the setting. This is especially when we want to purchase material, since there is too much detail that needs to be filled up. So they need to be sure in raising the Purchase Requesstion, otherwise there would be some problem later on. [Plant Operations Executive - E8]</td>
</tr>
</tbody>
</table>
ERP usage problems of system quality (functionality and usability), system utilisation, data quality and interface problems do not occur in isolation and they have inherent relationships. The relationships between SAP usage problems are exemplified in Figure 5.2.

**Figure 5.2: Diagram Showing the Relationships between ERP Usage Problems in Case A**

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Performance and Improvement Department</td>
<td>Due to unattractive interface difficulties of SAP, the engineers at Case A were unwilling to learn how to use it</td>
<td><em>I believe our staffs do not want to use it because of the boring interface of SAP. I actually did offer the engineers to attend the SAP training but most of them turned it down. They said, they will only learn it if they are at my position. For the new user, the unexciting interface of the system does not attract them to learn SAP.</em> [Operating Performance and Improvement Executive - E5]</td>
</tr>
</tbody>
</table>

Notes:
- **Affect/ leads**: Lead to/ cause (direct relationship) – one problem lead to the other problem
- **Aggravates**: Heighten/worsen/ exacerbate – one problem heighten the other problem
- **Influences**: Indirectly affect – one problem mediate the other problem
5.2.4 Antecedents of the ERP Usage Problem in Case A

In order to identify the factors that caused the ERP problems discussed in the previous section, data analysis was carried out through template (thematic) coding, as described in Section 4.6.4. Table 5.9 provides the summary of the factors that explain the causes of SAP problems in Case A, their definitions and sample interview logs.

Table 5.9: Factors that Explain the Antecedent of SAP Problems and Issues in Case A

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation</td>
<td>Lack of Funds</td>
<td>The complexity and inflexibility of SAP system make it very difficult and extremely expensive for us to have extensive modifications to the system. Besides, we also do not have sufficient funds to do so. [Manager of Operating Performance Improvement - M4]</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Lack of Support</td>
<td>I must say that in terms of SAP, iPerintis [our external consultant] also has limited knowledge. iPerintis is very helpful in assisting us with the PC based problem, but in terms of SAP, their staff are not well versed with the system. [Engineering and Services Senior Manager - M1]</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Lack of Control</td>
<td>I think the security level in our organisation is also another issue. For example, I should not be able to request a Purchase Request, and, at the same time, approve the Purchase Order. If I am able to do both, it will defeat the purpose of having this control….I have come across situations where profile setting is not appropriately done and some people who are not supposed to have the profile are given the profile. [Engineering and Services Senior Manager - M1]</td>
<td>10</td>
</tr>
<tr>
<td>User</td>
<td>Lack of Individual Strength</td>
<td>Basically, as far as I can see, the source of the data accuracy problem is the competency level. The maintenance personnel that are assigned to handle work notification, purchase requisitions and material reservations enter the wrong code resulting from their lack of skill to perform the required task. [Operating Performance and Improvement Manager - M4]</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Lack of Awareness</td>
<td>For the maintenance staff, they really need to be aware of the importance that what they have raised and what they have entered into the system is correct. This is because they cannot really see the relation between what they entered into the system and what the final result is. This leads to some of the problems</td>
<td>6</td>
</tr>
</tbody>
</table>
that we are facing. However, when we want to analyse the plant’s problem, what was being actually entered into the system is what really counted.
[Engineering and Services Executive - E2]

**Learning Styles Preferences**
The manner in which different elements from five basic stimuli affect an individual’s ability to perceive, interact with and respond to the learning environment (based on Dunn, Beaudry & Klavas (1989))

I could say there is a generation gap in terms of educating our SAP users. For the older users, they prefer to have textual interface. Whereas, for the new generation of SAP users, they like the friendly, interactive and visual SAP interface. This factor has an influence on them in terms of learning the system faster. The users’ learning curve is also different, some users learn it easily but some prefer a visual or pictorial version.
[Human Resource Management Administration - E10]

**Technology**

**Affordance**
The functions and operations that are provided by SAP (based on Behrens & Sederer 2004, p. 1720)

An executive at ESD (E2) noted that the affordance factor of SAP contributes to the unavailability problem of gathering the required scheduling and planning function. SAP cannot come out with the schedule. Hence, Microsoft Project is used for preparing the Gantt chart for the scheduling of maintenance job. As far as my work is concerned, I am not able to perform the planning of manpower by using the SAP system.
[Engineering and Services Executive - E2]

In the next section, each of these causal factors in relation to SAP’s usage problems is described in more detail.

**5.2.4.1 Organisational factors that contribute to ERP usage problems in Case A**

The findings indicate three important organisational factors that contribute either directly or indirectly to the system’s functionality and data problems of using SAP: **lack of funds, lack of support** and **lack of control**.

**Lack of Funds**
The level of SAP funding allocated in Case A is perceived as one of the contributing factors to the SAP problems of unavailability and non-interoperability. Most interviewees perceived that neither Case A nor the parent company adequately budgeted for the SAP upgrade and customisation. Although the majority of staff in Case A acknowledged the importance of the existing SAP system, there is a need for further improvement to keep pace with the rapid
changes occurring in the ERP system environment as well as the business requirements. However, upgrading to a new release requires an extensive capital investment and was affected by the company’s financial constraints. A senior manager in ESD (M1) echoed this view and stressed the additional cost involved in the customisation of SAP that is needed to overcome the interoperability issues: ‘With the latest SAP release, it can be integrated with the other applications in Case A and PATRON BHD. However, this new release would require a large amount of investment.’

When an ERP system does not adequately fit a company’s current work practices, organisations encounter the problem of ‘misfit’. This creates a gap between the functionality offered by SAP and the requirements of the organisation. One solution to close this gap is customisation. However, interviewees have reported that inadequate funding had affected the level of SAP customisation in Case A and the extent of functionalities those are available in the system. An executive working in Operating Performance and Improvement (E5) believes:

So, we have to customise some of the system functionalities, but we are aware that it will involve cost. The complexity and inflexibility of the SAP system make it very difficult and extremely expensive for us to have extensive modifications to the system since we do not have sufficient ERP funds to do so and the expertise is not widely available in PATRON.

[Operating Performance and Improvement Executive - E5]

Because Case A was unable to adequately invest in: (a) making all SAP modules available and (b) changing its business processes to fit SAP or customising SAP to handle the business processes, some SAP users have to rely on standard office software applications which eventually exacerbate the data quality problems. Two examples illustrate this. First, users in the Finance and Planning Department do not have SAP support for Product Costing because implementing the module would require an additional investment of around AUD616,880 (RM2 million) throughout the PATRON group (inclusive of Case A), which is considered too costly. This is illustrated in a comment made by an executive from the Finance and Planning Department (E12):

We have a specific reason for not using SAP for evaluation of our costing. This is because it is too expensive. Of course, the module is offered by SAP, but we have to incur an additional cost to use this module. Using the functions from SAP is expensive, so we just use Excel to do the analysis and evaluation of costing. Since Excel is serving a similar purpose, why do we not continue with Excel, which is much cheaper?
Second, the unavailability of a customised link between the SAP system and other applications (such as Intergraph) makes it impossible to integrate both applications. This, in turn, creates the SAP usage problem of system non-interoperability. Because of the unwillingness of the parent companies to spend money, it is not possible to integrate the Intergraph and SAP applications. This creates a system non-interoperability problem and limits the potential benefits. In the words of the senior manager in the Engineering and Services Department (M1), 'The problem is whether our parent company (PATRON BHD) is willing to invest further as there is a rapid change with the software version. PATRON BHD had invested huge money when we moved from SAP R/2 to SAP R/3 but now we want to reinvest further; this is also another issue in terms of funds.'

Unavailability of functions resulting from lack of adequate funding adversely affects the accuracy of SAP data. In addition, lack of funds that have caused limited customisation of system functionality aggravates non-interoperability issues and subsequently negatively affects data accuracy. For instance, due to the non-interoperability issues between these two systems, users keep two versions of data and manually adjust the data in each system by making a copy from one of the systems. An executive (E2) from the ESD remarked:

As soon as the changes took place for the information in SAP system, then the data in the Intergraph should be updated as well. We are unable to update in Intergraph immediately. As a start that is fine, we have duplication of data, one in SAP and another in Intergraph, but as the information revolves over time, this creates problems for us. Until we are able to provide that link, I would say that it is always a problem.

[Engineering and Services Executive - E2]

Lack of Support
In case A, iPerintis provides SAP users’ support. A number of interviewees indicated that the level of support provided by this external vendor is insufficient. For example, a senior manager from the Engineering and Services Department (M1) who had worked for 18 years at PATRON BHD, expressed his frustration at the level of technical support provided by iPerintis: 'I must say that in terms of SAP, iPerintis [our external consultant] also has limited knowledge. iPerintis is very helpful in assisting us with the PC based problems, but in terms of SAP, their staffs are not well versed with the system.'

Another participant (clerk) from the Finance and Planning (FP) Department (C13) had the same experience. She is still unable to fully rely on iPerintis for technical support because:
‘They [iPerintis] do not have the expertise and that is why we are quite slow in SAP.’ An executive from the same department (E12) supported her view by elaborating on the role of iPerintis stated in the contract.

It was stated in our agreements that all the IT technical services will be provided by iPerintis including the SAP system. However, when we migrate to iPerintis, the technical expertise was not available, especially for the SAP functions.

[Finance and Planning Executive - E12]

In addition, the unclear working arrangement between Case A, the Parent Company (PATRON BHD), and iPerintis in reporting and solving SAP issues made iPerintis’s response time to issues and problems very slow. A HRMA executive (E10) pointed out that SAP users are not simply able to call iPerintis when they need to. She said, ‘They need to know the people or who to call. For instance, if I have a problem with HRIS [Human Resource Information System Module] module, I need to log into the system first to get their technical expertise support, but sometimes things that can be done instantly would take one whole day to be resolved.’

The difficulty in reaching iPerintis at critical times has prolonged the problems encountered by end users and affected the accuracy of data. For example, at the time of the site visit (2010), the inaccurate calculation of mean time between failures (MTBF) remained unsolved by iPerintis. An executive from the Engineering and Services Department remarked (E3), ‘As I mentioned earlier, we encountered the problem in relation to the calculation of mean time between failures (MTBF). Unfortunately, we have to deal with it since iPerintis is still unable to reconfigure the SAP system. As for now, the MTBF data from SAP are still inaccurate.’

The lack of technical support from iPerintis is compounded by the lack of capacity to provide SAP support by the internal IT focal person in the Operating Performance and Improvement Department. The responsibility to coordinate internal IT activities is that of the Operating Performance and Improvement (OPI) Department. However, their involvement with the SAP system is very limited. As such, Case A has not developed the capacity of the OPI to provide SAP support. Instead, the OPI Department is more focused on supporting in-house developed systems rather than SAP. According to one interviewee (executive) from the OPI department (E5), ‘If users are encountering problems related to our online system, such as any bugs or errors in the application, they would inform us. So, we can render our support and troubleshoot the matters. Whereas, if the problem is related to SAP, it will take a longer time to solve since we need to seek expertise to look into it.’
From the remarks of various participants, it is evident that Case A has not created an effective structure to support SAP users. As a result, SAP users perceive SAP as too complex and difficult to use and are discouraged from learning and exploring the system further.

I feel so demotivated to use the system when I am unable to solve problems related to my work in the time needed. When I ask both iPerintis and even the OPI Department, they are unable to help me since they are also not experts in using SAP. Sometimes, I just feel so helpless! This affects my work from learning the SAP more. 

[Engineering and Services Executive - E3]

Therefore, in order to overcome the lack of support, users rely on their fellow workers or their own experience. An executive in the FP department said, 'Our IT consultants are also not experts in using SAP. So, most of the problems that we encountered, we tried to solve them by using our current knowledge [that we possess internally], through our own experience and also by asking other staff.'

In the long run, the lack of support definitely discourages employees from learning more about SAP.

**Lack of Control**

Case A implemented the SAP system to better manage its operations. However, judging by the interview responses, this was not entirely successful. This could be partly due to the lack of control that has contributed to SAP usage problems such as data inaccuracy. Generally, there are two types of IT control: general computer control and application-specific control (Ramos 2004). General control comprises data centre operations (e.g., job scheduling, backup and recovery); systems software controls (e.g., acquisition and implementation of systems); and access security and application system development and maintenance controls. Application control refers to the control of data processing; ensuring the integrity of transactions; authorisation and validity; and how different applications interface and exchange data. Case A suffers most from the lack of general control and, in particular, from the lack of access security control. This has contributed to data inaccuracy problems. Two areas illustrate this: (a) sharing the same SAP ID/password and (b) setting up a SAP profile.

Essentially, access control in ERP should be implemented by user authentication using a username and password. Ideally, each SAP user should have a unique user ID assigned to their specific user profile indicating their eligibility to access the system. However, sharing a SAP user ID and password is a common practice in order to resolve the underutilisation
issues of the SAP system and in order to save money. As the OPI manager opined, ‘Last 
year [2009], we initiated a review of the number of IDs for SAP. Some technicians do not use 
many of the IDs, but we keep on paying the charges. So, we reviewed the profile and tried to 
merge or resort through ID sharing.’ In this case, sharing ID was meant to overcome the 
underutilisation issue. Lack of control did not lead to underutilisation but the remedy for 
underutilisation led to lack of control.

Consistent with this view, the manager of the Technical Services Department (M9) indicated:

Every single department has their own focal person. In order to get a SAP ID, you 
need to pay the fee. So, to cut down the cost, only a focal person from the respective 
department is being allocated with the SAP ID. This ID would be shared among their 
colleagues within the same department. But there are also cases where user ID is 
shared across the department.

[Technical and Services Manager - M9]

The general practice of sharing SAP user IDs poses potential threats of unauthorised users 
gaining access to sensitive information, modifying data, entering fraudulent changes to 
programs and transactions, and committing other undesirable acts. Because of shared ID, 
different SAP users are able to enter or manipulate data and that creates a difficulty in 
identifying the ownership of particular work. An executive from the HRMA department (E10) 
gave an example of this problem.

There was an incident when our staff mistakenly keyed in the overtime figures twice. 
Since it is common to share the same ID, it is quite difficult to tell who entered the 
transaction.

[Human Resource Management and Administration Executive - E10]

Despite the disadvantages of SAP password sharing, some interviewees believe it is an 
acceptable practice, since what is most important for them is to ensure that the SAP data are 
being updated regularly. An OPI executive (E5) highlighted that it is more economical to 
share the SAP password, especially when SAP is used infrequently.

Surely there are some implications on the control, but in terms of updating, it is in the 
system. This is because most users update certain data in SAP just related to their 
work, which is only 2 or 3 times a week. SAP users need to update their work in the 
system whereby there is a column to fill up their names. In the instance where users 
use a common ID such as ‘Ahmad’, they would be able to key in the name in the specific column allotted. However, in terms of control, we are still unable to determine 
whether the request was originally made by Ahmad.
Although by having a shared password user are able to update their work regularly, the disadvantage of this practice is that the security of the system is jeopardised by not knowing which specific person is responsible for specific transactions.

The second area of the lack of security control is related to how SAP profiles are set up. As part of the SAP system access control, profiles were originally allocated to certain groups of people who were only allowed to access specific areas of the system. The access profiles also differentiate between display-only and full access to data. For instance, users from the Plant Operations Department are able to view the Purchase Requisitions created by the Engineering and Services Department but they are not able to amend them. However, lack of control is underlined by the low security levels that exist in Case A. A senior manager from ESD (M1) highlighted his dilemma when he received an authorisation to create a Purchase Request and, at the same time, he was able to approve the Purchase Order (see Table 5.9 for detail).

Another area of loose control on profile set-up relates to staff movement. When users move to other operating units or departments, they also need to change their user profiles. Only iPerintis is able to amend the SAP profile. However, sometimes, if iPerintis does not understand the end user’s exact requirements, they fail to update the user profile correctly. Consequently, it can lead to one user having two separate profiles, as illustrated in the following two examples.

In my case, previously, I was attached to the Health Safety Environment (HSE) Department. I am the approval authority for the HSE Department. So, when I view my profile, I am able to view the Purchase Request or the Services Request of the HSE Department. Since I have already moved to Plant Operations, I have requested another profile for this department. This is because the PO Department is quite large and our cost centres are quite scattered. Besides, I am also responsible for overseeing the sales and the product.

I think at the initial stage of SAP implementation, it is OK to use the profile. As we move along [due to the operation changes], say I am supposed to have a profile to request the Purchase Requisition but as the organisation changes, now I need to approve the Purchase Requisition. However, we forget to remove the 'my request of PR’. I think this is the issue for post-implementation phase of ERP system since in the
beginning, our people are eager to get it moving but once we already moved to a certain level, we just continue without looking back.

[Engineering and Services Senior Manager - M1]

Lack of control also results in incorrect data entry in the Engineering and Services Department. Due to the lack of control exercised in Case A, the technicians from ESD simply keyed in the generic cause code of equipment failure, which did not reflect the actual equipment condition in the plant. This situation happened when they received a large amount of work orders at the same time. According to a statement by an executive from ESD (E3); ‘Most of the problems that we face are basically because our staff entered the wrong data. As such, without further review from the responsible party, the inaccurate cause code used in the system led to inaccuracy in SAP data that would affect detail analysis of the equipments’ failure.’ To summarise, loose control in sharing user ID, incorrectly updating user profiles and inaccuracy in entering cause codes have played an important part in the inaccuracy of SAP data.

**Figure 5.3: The Influence of Organisational Factors on ERP Usage Problems in Case A**

Notes:
- **Affect/ leads**: Lead to/ cause (direct relationship) – one antecedent factors lead to one problem
- **Aggravates**: Heighten/worsen/ exacerbate – one problem heighten the other problem
- **Influences**: Indirectly affect – one problem mediate the other problem
- **Cope by**: To overcome - one problem overcome by one coping mechanism
Figure 5.3 depicts the relationship between organisational factors (lack of funds, lack of support and lack of control) and ERP usage problems.

**5.2.4.2 User-related factors that contribute to ERP use problems**

Analysis of the interviews highlights *individual strength, awareness and learning style* as the three main user-related factors.

**Lack of Individual Strength**

Lack of individual strength refers to when users do not possess the self-confidence to do their work by using SAP. Two examples illustrate how lack of strength contributes to data inaccuracy and underutilisation problems.

In the first example, the lack of individual strength caused a data accuracy problem during the preparation of the monthly closing accounts in the Finance and Planning Department. An executive from the department (E12) claimed that a mismatch between the sub-ledgers and the general ledger account was related to the user’s lack of strength.

> At the end of every month, we are supposed to close the account. Yet, from the maintenance module, there are some pending accounts. When this thing happens, it impacts our Profit and Loss account as it is no longer accurate. The problem related to the maintenance module is caused by the way we are doing our thing. When the end user prepares the work order, things such as the date would affect the settlement of the work order but what happens is that most users are still uncertain about what needs to be done.

[Finance and Planning Executive - E12]

In the second example, the OPI manager (M4) mentioned the problem of identifying the cause code of an equipment fault. According to him, because the OPI staff lack skills, they tend to make mistakes when entering data in the SAP system (as reported in Section 5.2.3.2).

> Basically, as far as I can see, the source of the data accuracy problem is the competency level. The maintenance personnel that are assigned to handle work notification, purchase requisitions and material reservations enter the wrong code resulting from their lack of skills to perform the required task.

[Operating Performance and Improvement Manager - M4]
One executive, who had worked at Case A for more than 10 years in the Engineering and Services Department (E2), highlighted that the data inaccuracy found in the calculation of MTBF (mean time between failures) is partly related to the mistakes that users make while using the SAP system. Because the end users do not have enough confidence and experience concerning how to use the system correctly, mistakes such as entering inaccurate data are frequently made, leading to the deterioration in data quality.

To reinforce this example, one executive from the Engineering and Services Department (E3) stressed the importance of users completing the relevant columns in SAP so that they could be used for future analysis or reference.

For instance, the remark column is very useful for us in the future. Say, for example, the equipment keeps on failing, so we have to know its history, what happened to the equipment so that we can derive some conclusion! Maybe the equipment has been failing for the past two years, what is the reason for this?

[Engineering and Services Executive - E3]

In addition, users’ lack of strength results in the inability to gather the precise information regarding the extent to which problems exist. The same executive (E3) elaborated on this:

What happened was due to the user's lack of strength. For instance, when they tick or indicate 'job done' or 'work completed', but what does it mean by 'job completed', as they said 'Why should I need to spend more time to think about it?' From our point of view, we want to know exactly what was happening.

[Engineering and Services Executive - E3]

The executive stressed that lack of user confidence has affected the analysis of equipment fault reporting in that users have entered incorrect cause codes for equipment failures. Hence, changing the mindset of users is considered crucial since, as this executive remarked, ‘For example in identifying the damage or cost code, for some users, it is not important to be serious about this. However, it will adversely affect a later analysis.’

Third, users’ lack of individual strength has resulted in underutilisation of the SAP system. This is evident in the following quotation.

Besides being unable to close the open items, the problem is my lack of skills as well. I do not fully explore the SAP functionalities. I just do whatever is required by my section. For example, I only focus on my part while preparing the Accounts Payable… It is all due to my skill setback. I am yet to explore the SAP. All along, my focus has only been on what concerns my section. The SAP system is quite segregated in
nature. As a user, I face limitations that I cannot see the other side of SAP. Again, I need to emphasise that it is the monthly closing work that poses certain difficulties on my part.

[Finance and Planning Clerk - C13]

The analysis of the data also identifies two main reasons that contribute to users’ lack of strength: limited SAP exposure and limited IT skills. For example, one interviewee said, ‘Our lack of individual strength with SAP is caused by the limited requirement to use it. We do not have any experience in using many of the SAP functionalities, since Case A is quite a small OPU in PATRON.’ (E12)

The manager from the Technical Services Department (M9) believes that there is a significant correlation between users' ability to use a computer and SAP system usage: ‘I think there is a permanent link between users’ ability to use a computer system and the SAP system. If you are not really familiar with another system, like the one we had back 10 years ago, usage of SAP would definitely be very difficult.’

In another instance, learnability problems of end users have resulted in a low confidence level in using SAP. This lack of individual strength then leads to system underutilisation and the data problems that have been previously discussed. From the comment by a manager of Plant Operations:

I have to refer back to the training material because the system is quite comprehensive. I would say that it is slightly complicated to use. This has affected my self-confidence to use SAP as I am too dependent on the material. I believed my subordinates also experienced the same things.

[Plant Operations Manager - M7]

**Lack of Awareness**

Lack of awareness refers to the SAP user's lack of awareness (consciousness) on how their task will be completed by using the SAP system (see Table 5.9 for a detailed definition). Awareness is different from individual strength. While individual strength signifies the user confidence level in performing tasks by using SAP, awareness is associated with attentiveness – how the task could be completed through SAP. User awareness results in greater confidence in using the system and lack of awareness results in a low confidence level (individual strength).
A supervisor in the Human Resource Management and Administration Department remarked: ‘We do not see the benefit of the system in the early stage. For example, in terms of reporting, supposedly it is much easier to use SAP where we do not need to retype the same things.’ Users’ lack of awareness affects the way they do their work, slows down their learning about SAP and leads to mistakes in data entry.

An executive from the Engineering and Services Department (E3) believed that it is critical for the maintenance staff members to be attentive to their work since they sometimes fail to envisage what their actions mean for the SAP system. This executive said:

For the maintenance staff, they really need to be aware of the importance that what they have raised and what they have entered into the system is correct. This is because they cannot really see the relation between what they entered into the system and what the final result is. This leads to some of the problems that we are facing. However, when we want to analyse the plant’s problem, what was being actually entered into the system is what really counted.

[Engineering and Services Executive - E3]

Lack of user awareness was found to lead to data inaccuracy, as reported earlier in this chapter. A senior manager working in the ESD (M1) noted that the data quality problem was caused by the lack of user awareness (mindset):

The challenge here is caused by the people themselves since it is already in their mindset. Some of them said, ‘I do not use the information, why should I be bothered about it?’ However, for us, this is very important because we are the ones who run the analysis based on the data received. If you put garbage in, you will get garbage out at a later period. This is where we need to change the user's mindset.

[Engineering and Services Senior Manager - M1]

The underutilisation issue that was reported earlier is also influenced by users’ lack of awareness. For instance, some participants believe that the inability of SAP to offer analysis functionalities is not because of the unavailability of the functions but due to users’ lack of awareness. This is illustrated by a comment made by an executive from the Operating Performance and Improvement Department: ‘I think in SAP, there are some functions to analyse what we have purchased or where our current status is. I think they should have it in SAP. It is just that I am not exposed to it. We cannot do the analysis using SAP because of the lack of awareness on advanced usage of SAP by the end user.’ (E5)
Learning Style Preferences

Different types of users in Case A favoured different ways of learning. This is evident in a statement made by an executive in the HRMA Department:

I could say there is a generation gap in terms of educating our SAP users. For the older users, they prefer to have textual interface. Whereas, for the new generation of SAP users, they like the friendly, interactive and visual SAP interface.

[Human Resource Management and Administration Executive - E10]

Learning styles affect users’ SAP efficacy, which, in turn, leads to ease or difficulty in learning. The HRM executive stated: ‘Users' learning curves are also different, some users learn it easily but some prefer a visual or pictorial version.’ Another executive of the Engineering and Services Department commented, ‘So, they need to use SAP to generate the reports. As the SAP interface is not user-friendly, users are unable to get the desired report. That is why we must have an alternative that has a better interface.’ (E5)

Figure 5.4 displays the influence of user factors (lack of individual strength, lack of awareness and learning style preferences) on SAP problems in Case A.

**Figure 5.4: The Influence of User Factors on SAP Use Problems in Case A**

Notes:

- **Affect/leads**: Lead to/ cause (direct relationship) – one antecedent factor lead to one problem/another antecedent factor
- **Aggravates**: Heighten/worsen/ exacerbate – one problem heighten the other problem
- **Influences/Contributes**: Indirectly affect – one problem/ antecedent factor mediate the other problem
- **Cope by**: To overcome - one problem overcome by one coping mechanism
5.2.4.3 Technology-related factors that contribute to ERP use problems

Another aspect that contributes to the SAP problems in Case A relates to technological affordance. Several interviewees pointed out how the lack of affordance contributes to functional unavailability, especially in relation to the planning and scheduling functions in the Engineering and Services Department. One of the interviewees remarked:

We are unable to get the schedule function from SAP. Hence, Microsoft Project is used for preparing the Gantt chart for the scheduling of maintenance jobs. As far as my work is concerned, I am not able to perform the planning of manpower by using the SAP system.

[Engineering and Services Executive - E3]

Similarly, another executive (E3) from the same department commented on the lack of affordance that has encouraged her to use alternative software: ‘I wanted to see the entire Gantt chart but I could not find it in the system (SAP). So what we did was to extract all the work orders from the SAP and transfer them to Microsoft Project.’ She explained that she used SAP to monitor the schedule of maintenance jobs. However, due to the affordance problem in SAP, it failed to generate the required data for producing a monthly analysis. She added, ‘as for now, when I am doing the report, I need to extract all the compliance and costing data from SAP and transfer it to the other software for reporting purposes.’

Figure 5.5 illustrates the influence of lack of affordance on SAP usage problems in Case A.

Figure 5.5: The Influence of Technology Factor on ERP Usage Problems in Case A

Notes:
- **Affect/ leads**: Lead to/ cause (direct relationship – one antecedent factor lead to one problem
- **Cope by**: To overcome - one problem overcome by one coping mechanism
5.2.5 Coping Mechanisms

The findings from Case A revealed that most users who experience SAP problems do not seem to have any mechanisms to cope with the problems. One of the ways employed by end users was inaction or ignoring the problem (see Section 2.4 for a detailed description). From the review of previous literature, it emerged that this strategy was typically employed by end users when they encountered ERP system issues. Inaction or ignoring a problem was not regarded as an effective strategy for minimizing ERP problems (Benamati & Lederer 2001). However the findings from Case A suggested that the majority of end users adopt this practice. Because SAP is a mandatory information system in this organisation, users do not have much option but to continue using it. When problems arise, they usually cannot turn to another system. This is an emotion-focused coping mechanism. An executive at the Engineering and Services department (E3) stated:

We cannot do any work without SAP because all the data and information and how to engage with external consultants, all need to be done through SAP. Even though the SAP system is complicated, we still need to go through SAP. If we have a problem, we ask for the solution from the central team but the job still has to be done through SAP.

[Engineering and Services Executive - E3]

Some of the SAP users in Case A who have faced system-related issues (system complexity and unavailability), data quality (inaccuracy of data) and interface problems have adopted various problem-focused coping mechanisms when encountering problems with SAP. Chief among the coping mechanisms adopted by users are feral information systems, feral use of technology to work around the SAP system and bypassing it altogether. These types of problem-focused coping are described in Section 2.4. However, as reported from Case A, end users tend to cope with ERP system problem by adopting both forms of coping mechanisms: problem-focused and emotion-focused. The rest of this section discusses how end users use the problem-focused coping mechanisms that form the greater role in dealing with ERP system usage problems.

5.2.5.1 Feral Information Systems

Feral information systems are created to be comprehensive systems with input, processing and output elements (Houghton & Kerr 2006). In the Finance and Planning Department (FP), users who faced system complexity problems have reverted to creating and using a Bank
Reconciliation IS as a coping mechanism. Bank Reconciliation is a web-based system created outside the accepted ERP system environment by an individual from the Finance Department. The Corporate Information Development Unit (CIDU) has not sanctioned the development of the Bank Reconciliation. Therefore, iPerintis does not support this system.

According to an executive from the Finance and Planning Department (E12), at first when she was assigned to the department, she thought that everybody would use the SAP bank reconciliation process since it is part of the Accounts Payable functions. However, to her surprise, although the Bank Reconciliation function is available on the SAP system, Finance and Planning staff members prefer to use the Online Bank Reconciliation system. One SAP user from the department stressed the ease in using it: ‘The online version of bank reconciliation is much simpler. It is very simple since our transactions are not that much.’ Another interviewee, a clerk from the same department, supported this view:

To use SAP bank reconciliation is quite difficult since we are not so familiar with the function. Besides, the online system has been used before I joined the company. Since it is already there, we just use it. I do not see the need to change to SAP.

[Finance and Planning Clerk - C13]

Both of the Finance Planning staff members believed that it is possible to migrate to the SAP bank reconciliation function in the near future; yet the process still requires the data to be cleaned up:

We have to do the clean up before we run the bank reconciliation through SAP. We need to clean up especially the SAP account codes. Otherwise, there will be many line items not being reconciled.

[Finance Planning Executive - E12]

Invoice Tracking System is another example of a feral information system found in Case A to overcome or bypass problems of complexity. An individual from the Finance and Planning Department developed this system and it has been employed since 2005 for the purpose of tracking and monitoring vendors’ payments. Neither iPerintis nor Corporate Information Development Unit (CIDU) has sanctioned its creation. Thus, iPerintis is not responsible for supporting the Invoice Tracking System. This system duplicates the monitoring functionality of SAP. In fact, both systems (SAP and Invoice Tracking System) record the relevant processes concurrently. One executive from the Finance and Planning Department (E12) described how the Invoice Tracking system worked:

Invoice Tracking System is used to monitor outstanding payments to vendors. So, whenever there are invoices yet to be approved, we put them there. There is also a
similar function in SAP for tracking invoices. Invoices will be keyed-in into the Invoice Tracking System and at the same time, we will update into the ‘park document’ function of SAP. We are doing it simultaneously.

[Finance Planning Executive - E12]

The reason for developing the Invoice Tracking system was to overcome the complexity issue faced by SAP users in the Finance and Planning Department. According to an executive in this department (E12), she uses Invoice Tracking system because the function in SAP is quite complex to use:

I have tried to use the tracking function from SAP but it is so stressful since I have to know which button to click or the next step required in order to view the status of our vendor. Hence, although the similar function is available through SAP, we prefer to use the Invoice tracking system since it is much easier for us to monitor our vendor.

[Finance Planning Executive - E12]

The executive (E12) then further explained that from the ‘park document function’ of SAP, they generate a report showing the invoice’s status. Once the payment is received by the Finance and Planning Department, the responsible staff member removes it from the ‘park document’ and posts it to the actual cost account of SAP. The Invoice Tracking system duplicates the functionality of the SAP system. A similar task in preparing bank reconciliation could be carried out by using both the Invoice Tracking System and the SAP system.

5.2.5.2 Feral Use of Information Technology

Apart from the feral information system, SAP users are using standard software applications to overcome the problems of ERP system complexity, unavailability and non-learnability. This action is referred to as feral use of information technology. The complexity of SAP in scheduling and planning (see Table 5.4) and the lack of a number of functions such as notification and analysing abilities and reporting functionalities (see Table 5.5) results in the use of alternative software.

First, one of the functions that a number of users need in SAP is a scheduling function but the customised scheduling function that is required by users is not available in the SAP system. Therefore, users are forced to depend on Microsoft Project and PRIMAVERA for scheduling and planning turnaround and shutdown processes (as noted in Table 5.4). An
executive in the Engineering and Services Department said that he cannot be sure that the scheduling function is available through SAP.

We use Microsoft Project for the scheduling. I am not sure whether the function is available in SAP or not. I never explore it further ...We were also doing our planning outside the SAP [for example, by using Microsoft Project]. Let’s say, for shutdown, we need to plan the job upfront, so we use Microsoft Project to plan for each job. For instance, how many hours it will take. [Engineering and Services Executive-E3]

Resorting to Microsoft Project as a coping mechanism indicates the way users try to deal with not only the complexity issue but also the unavailability (system functionality) problem that besets SAP. During the researcher’s site visit, a customised scheduling function was not yet available through SAP. An executive (E3) from the Engineering and Services Department elaborated on this scenario: ‘One of the problems is in terms of scheduling because we cannot find the scheduling function in SAP. Let’s say, if we are using other systems such as Microsoft Project or Primavera, we want SAP to automatically integrate the scheduling system. That will be convenient to us.’

The same executive (E3) reflected on her frustrating experience with SAP planning functionalities. Despite the detailed manpower planning available in SAP, what she required was only the generic plan:

SAP still cannot help with the planning that I am required to do. SAP is only able to do the planning for the manpower. The planning done by SAP is very detailed but not for general things. In SAP, we can also group the work according to the category. For example, we have the job where there are equipment failures in the plant but then, we cannot attend to the job while the plant is running or we need to attend them when the plant is shut down, so we group that into AWSD [awaiting shut down job].

[Engineering and Services Executive - E3]

To solve this problem, she extracts the work order from SAP and transfers it into Microsoft Project, which is very helpful for project planning. It can be used to develop plans, assign resources to tasks, track progress, manage the budget and analyse workloads. Microsoft Project software generates the Gantt chart that keeps track of the project status from start to completion.

Secondly, besides lacking scheduling, the SAP system lacks notification and analysing functions. The unavailability of these functionalities was discussed earlier (see Table 5.5). For instance, the SAP system cannot generate a maintenance job summary and provide a
summary of analysis for the Mean Time between Failures (MTBF). To cope with these sorts of limitations, an executive (E3) from the Engineering Services Department said:

We normally use Excel because it is easy for us to see the overall status of the maintenance job. So, if SAP has this function, it is much better to us because initially, we receive the data from SAP. Then, we need to transfer it to Excel and update it. For me, it is double the work. Excel is used for analysis purposes because SAP is unable to provide us with some of the required functionalities.

[Engineering and Services Executive - E3]

Thirdly, to overcome the problems that users experience in report documentation, Microsoft Excel is also used extensively. For example, if users want to know the cost of equipment and also the Mean Time between Failures (MTBF), the reports are done through Excel since additional calculations are required. In this case, the SAP system is used to download all the relevant data into Excel, and then the data are manipulated in a simpler, more graphic summarised report to be presented at the weekly meeting. However, by taking data out of the SAP system and manipulating them in another program (Excel) that does not impose access restrictions, data can be (intentionally or unintentionally) falsified, producing erroneous results that would lead to data quality problems.

A number of interviewees from the Engineering and Services Department highlighted how Excel overcame SAP’s inability to provide customised reporting tools and sophisticated reporting capabilities. One executive from the Engineering and Services Department (E3) described this situation:

You cannot generate reports from SAP. The purpose of SAP is mainly to key in the data and attach the report, so that other people could use it for future reference. You can just click this button (in Excel) to know the history, let’s say on the equipment failure and then, you key-in into the SAP… SAP is a system where you can gather all the information that you have and store it in one particular system. However, detailed reports need to be done separately, in Excel or others.

[Engineering and Services Executive - E3]

Another executive from the same department (E2) supported the above view. He believed that the reason for employing software such as Excel is to make their work easier. Excel is used to summarise all the jobs that have been done, even though SAP has a similar function. He said, ‘We still keep a separate Excel file. We create the Excel file ourselves. It is intended to help us, to make our task easier!’
In the Operating Performance and Improvement Department, Microsoft Excel provides a better layout and presentation of reports because reports generated through Excel are tabulated to suit user requirements better than what SAP offers. From the point of view of an executive in the OPI department (E5):

We extract the data from SAP to Excel. So, we customise the tables and from the tables we just create the analysis graphs, meaning that all the reports are done in Excel format. This is because some of the required reports are not standard reports in SAP. So, if we want that kind of report, we have to customise. Let say, the report only generates 5-lines items. For us, our requirements, we need a 7-lines item. So, we cannot use SAP. We have to use other ways other than SAP because SAP only has standard format or standard analysis or field.

[Operating Performance and Improvement Executive - E5]

By feral use of information technology such as Microsoft Excel, users indirectly create feral data. This mechanism is used to cope with SAP limitations in terms of unavailability of customised functionality and poor interface design. Feral data refers to data stored outside the formal system (SAP). In the literature, it is reported that users often extract data from the formal system (ERP) and make necessary adjustments or modifications as needed (Kerr & Houghton 2008; Kerr, Houghton & Burgess 2007). However, when such users fail to integrate the data back into the formal system for operational reasons, or for forecasting or knowledge management purposes, this can lead to the data being out of sync with formal systems and turn into feral data. For instance, in Case A, staff did computations for taxation figures without SAP but used Excel instead. An executive in the Finance and Planning Department (E12) pointed out the calculation for the deferred taxation, noting, ‘Certain things you have to do outside SAP. Like deferred tax, where you need to do the calculation outside and posted into the SAP system. You need to have that kind of schedule or working outside the system.’

Another example from the Finance and Planning Department is SAP users having to manually adjust the overdue date of the SAP data to Excel in order to generate monthly financial reports. Instead of configuring SAP to produce the dates in the format that a user wanted, overdue data has to be adjusted for, meaning that the capabilities of SAP are bypassed. A clerk in the department (C13) said:

I wish I could print out the report straight away from the SAP. For instance, let’s say the date is not due yet but when I do the report, it is shown as due. This is the setback in SAP. I have to adjust it manually. When I use Excel to do the report, I would follow the SAP template so that it can be easily understood. I just need to
adjust the due or overdue dates, unless in some cases where the data is not supposed to be there. I just have to check the appropriateness of data and make necessary adjustments when needed; later on, we upload the data into SAP.

[Finance and Planning Clerk - C13]

Using an alternative system such as Excel is viewed as a reasonable option due to the restrictions concerning SAP ID. Since not all staff in the Engineering and Service Department (ESD) is entitled to access the SAP system, the data prepared outside the system can be shared among the technicians. The same executive from ESD (E2) added:

So we just keep the data outside the SAP to distribute to technicians because sometimes they do not have the authority to view that equipment’s report. SAP profiles are based on job position. Not everybody can view everything in the SAP because of a certain level of authority. So we download the data from SAP, transfer to Excel format and later distribute it to technicians.

[Engineering and Service Executive - E2]

5.2.5.3 Bypassing SAP

In the Finance and Planning Department, to determine the damage code for equipment failure, maintenance staff key in the cause code. However, when they are unable to identify the specific cause code, then a generic cause code is used to classify equipment failure. The problem with the cause code is that it reflects the equipment’s actual problem. This has led to creating inaccurate SAP data. In order to solve this problem, maintenance personnel simply bypass the transaction. This is explained by an executive of ESD (E2):

Normally, it is the technicians who entered the code themselves because they are involved in the troubleshooting. So, what they usually did was to enter the generic cause code for equipment failures. The engineers would verify back to us what has been entered into the system. Yet, due to the large volume of orders, they normally bypass it or close it. So when we extract the data, it is not accurate any more.

[Engineering and Service Executive - E2]

To cite another example, one executive from ESD (E3) suggested that sometimes they bypass the SAP system altogether. She quoted an instance when there is a minor maintenance job and the job requires completion quickly (in 5 or 10 minutes). In this instance when the plant analyser is offline, the data relating to the maintenance job will not be captured in SAP. She explained:
Basically, every type of job needs to be captured in SAP but there are some minor jobs that do not really need to be included in SAP. Basically, any job that did not require much time, we did not capture in SAP.

[Engineering and Service Executive - E3]

However, when maintenance work is going to take longer, it must be keyed into SAP because it would affect the technicians’ time, as they need to key it in on a monthly basis as well as keep track of the order number.

5.2.6 Summary of Case Report A

Findings from Case A revealed five categories of usage problems faced by SAP users: system functionality, system usability, system underutilisation, data issues and interface issues. In system functionality, complexity and unavailability are central to the problem. In addition to issues of complexity, participants from Case A stressed the unavailability of customised functionalities offered by SAP. For instance, scheduling, planning and the ability to generate customised reports are completely lacking. Alternatively, the end users opt for a way out by using standard software such as Microsoft Excel, Project, Access and others. Another problem noted is the poor interface design of SAP that discourages users from using the system. The unfriendly, textual and conventional SAP system layout deters users to a significant extent, and they become sceptical about learning the system further, thus leading to underutilisation problems. Nevertheless, the least reported problem found is the data issue. The inaccuracy of SAP data is reported only in the area of calculation for the Mean Time between Failure (MTBF) of equipment failure in the Engineering and Services Department.

The Case Study Report also describes the antecedent factors to those identified usage issues. Based on the four major categories of organisation, users, tasks and technology derived from the initial conceptual framework (see Figure 3.1); seven antecedent factors which lead to ERP usage issues were found: support, control, individual strength, awareness, learning style preferences and technology affordance. The usage problems and causal factors lead to end users developing coping mechanisms. These coping mechanisms are either a feral information system, feral use of information technology or system bypass. Microsoft Excel is used extensively in Case A because SAP does not have the ability to create or generate reports, while Microsoft Project has the advantage of being able to schedule and plan processes. Figure 5.10 depicts the relationships between the SAP usage problems and the respective causal factors (organisation, user and technology) and coping mechanisms employed by SAP users.
Figure 5.6: Diagram of ERP Usage Problem, Antecedent Factors and Coping Mechanisms of Case A
5.3 CASE STUDY 2: CASE B

5.3.1 Background Profile of Case B

Case B is a public limited company founded in 1991, incorporated and domiciled in Malaysia. The company is listed on the Main Board of Bursa Malaysia Securities Berhad. The registered head office is in Kuala Lumpur, Malaysia. At the time of data collection, Case B had 2274 employees. Case B’s major activity is manufacturing automotive components for the growing number of car makers in Malaysia and the ASEAN region that involves moulding components, impact system, door sash, automotive door assemblies and bellows. Besides the five principal activities, Case B also provides consultation services in the power engineering and railway sectors. Further, the company offers industrial automation and automatic tank cleaning services to several industries including the oil and gas sector. Apart from Malaysia, Case B operates in Thailand, Indonesia and India. It has fourteen subsidiaries, of which ten are in Malaysia, two in Thailand and one each in Indonesia and India. Case B has six main divisions: the Group Human Resource, the Group Finance and Corporate Service, the Group Technical Services and the three manufacturing divisions (Automotive Component Manufacturing, Power Engineering, and Product and Premium Auto Dealership (as shown in Figure 5.7).

Figure 5.7: Group Structure of Case B

![Group Structure of Case B Diagram]

Source: Extract From Case B Company Profile Web Site
For the purpose of this study, data were collected from the **Group Finance and Corporate Division** (identified as **CBCD** in this report) and **one of the Malaysian subsidiaries of Case B** (henceforth referred to as **CBSC**) that is in the Automotive Component Manufacturing Division. CBSC was incorporated in 1999, employs 250 people and is a manufacturer of complete 'door-in-white' and other door-related products for the passenger car market in Malaysia. A total of 13 interviews were conducted in both CBCD (6) and CBSC (7). Table 5.10 provides a profile of the data collection.

5.3.2 IT Department and ERP (SAP) System in Case B

Case B has an internal IT department – MIS and SAP – with a senior manager as leader. The department is responsible for formulating the IT policy suits of the company and ensuring that the business objectives are aligned with the IT objectives. This is considered the highest level of responsibility of the senior manager of the MIS and SAP Department, who noted, ‘I am supposed to bridge the gap between the business and the IT objective so that the company will gain return out of IT expenditures.’ (M14)

The MIS and SAP Department comprises three main units: SAP, System and Infrastructure, and MIS Unit. The SAP Unit oversees and provides support to the four main SAP modules implemented in Case B. The MIS unit is responsible for ensuring compliance to MIS policy, the reliability of data and the stability of any system. The System and Infrastructure Unit is responsible for managing the IT infrastructure needed throughout Case B and all the subsidiaries in Malaysia, Thailand, Indonesia and India. Twenty focal people from the total number of 75 IT employees in the MIS and SAP Department serve and coordinate the IT matters throughout the group. The organisation chart of the MIS and SAP Department of Case B is shown in Appendix 5.1.

The ERP system that is currently implemented in Case B is SAP. The implementation began in 2003 with the introduction of SAP R/3 4.6C and was upgraded to SAP ECC5 in 2006. The SAP system implementation does not cover the whole group. Apart from the Group Finance and Corporate Division (CBCD), only four of the 14 subsidiaries are using the SAP system, one of which is the CBSC. The SAP module that is used at the CBCD is the Financial Information and Controlling (FI & CO) module. In the CBSC, four modules are used: Financial and Controlling (FI & CO), Sales and Distribution (S & D), Material Management module (MM), and Production and Planning (PP).
Table 5.10 Summary of Data Sources of Case B

<table>
<thead>
<tr>
<th>Name of Document</th>
<th>Document Codes</th>
<th>Interviewees' Job Titles</th>
<th>Interviewees' Code</th>
<th>Department</th>
<th>Job Scope</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case B Annual Report 2009–2010</td>
<td>DB1</td>
<td>Senior Manager</td>
<td>M14</td>
<td>MIS and SAP</td>
<td>Head of the IT Department, oversee all IT matters, in charge of SAP and any group's applications</td>
<td>CBCD</td>
</tr>
<tr>
<td>Case B Annual Report 2008–2009</td>
<td>DB2</td>
<td>Manager</td>
<td>M15</td>
<td>MIS and SAP</td>
<td>Managing MIS Unit</td>
<td>CBCD</td>
</tr>
<tr>
<td>CBSC Assessment</td>
<td>DB3</td>
<td>Internal Consultant</td>
<td>E16</td>
<td>MIS and SAP</td>
<td>Providing SAP expertise of FI and CO modules</td>
<td>CBCD</td>
</tr>
<tr>
<td>MIS Organisation Chart of Case B</td>
<td>DB4</td>
<td>Internal Consultant</td>
<td>E17</td>
<td>MIS and SAP</td>
<td>Providing SAP expertise of FI and CO modules</td>
<td>CBCD</td>
</tr>
<tr>
<td>SAP Audit Findings and Recommendations</td>
<td>DB5</td>
<td>Assistant Manager</td>
<td>M18</td>
<td>Group Finance</td>
<td>Responsible for the Group Financial Statement (Consolidation Account)</td>
<td>CBCD</td>
</tr>
<tr>
<td>CB IT Review Draft of Management Letters</td>
<td>DB6</td>
<td>Supervisor</td>
<td>S19</td>
<td>Group Finance</td>
<td>Processing of account via SAP (payment, petty cash, claim, Interco and bank reconciliation) and preparation of journal</td>
<td>CBCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manager</td>
<td>M20</td>
<td>Finance</td>
<td>Overseeing the Financial Management of CCSC and managing three sections (AP, AR and Treasury)</td>
<td>CBSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assistant Manager</td>
<td>M21</td>
<td>Finance</td>
<td>Monitoring the Finance Department and in charge of Costing</td>
<td>CBSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Executive</td>
<td>E22</td>
<td>Production Planning and Control (PPC)</td>
<td>Focal person of SAP in CCSC and Planning section</td>
<td>CBSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supervisor</td>
<td>S23</td>
<td>Production Planning and Control (PPC)</td>
<td>Coordinating/Controlling the factory's logistics flow</td>
<td>CBSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clerk</td>
<td>C24</td>
<td>Production Planning and Control (PPC)</td>
<td>Recording and SAP data entry for production process</td>
<td>CBSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assistant Manager</td>
<td>M25</td>
<td>Purchasing Vendor Development (PVD)</td>
<td>Responsible for Trade and Non-trade transactions</td>
<td>CBSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clerk</td>
<td>C26</td>
<td>Purchasing Vendor Development (PVD)</td>
<td>Processing purchasing via SAP, creating the PO, pricing and preparation of the stock analysis</td>
<td>CBSC</td>
</tr>
</tbody>
</table>

P Code: Participants Code *CBCD = Case B Group Finance and Corporate Division *CBCS = Case B Subsidiary Company
The SAP system is rolled out by a consultant based on the Accelerated SAP (ASAP) methodology, which is a structured implementation approach that helps to achieve a faster implementation with quicker user acceptance, well-defined roadmaps and efficient documentation at various stages (Esteves & Pastor 2001). Table 5.11 provides a snapshot of the company's profile.

Table 5.11: Summary Profile of Company B

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Background</strong></td>
<td></td>
</tr>
<tr>
<td>Industry Sector</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>Business Segments</td>
<td>Automotive Power Engineering and Project</td>
</tr>
<tr>
<td>Incorporation</td>
<td>May 1991</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>2274</td>
</tr>
<tr>
<td>Core Products</td>
<td>Automobile components and assembly parts for the door module, sealing system, under and front body module, exhaust system, impact system and heat management</td>
</tr>
<tr>
<td>Additional Products</td>
<td>Power engineering, railway and oil and gas services</td>
</tr>
<tr>
<td>Outstanding Shares</td>
<td>Listed company (Kuala Lumpur Stock Exchange)</td>
</tr>
<tr>
<td></td>
<td>Listed in Main Board of Bursa Malaysia Securities Berhad</td>
</tr>
<tr>
<td><strong>IT and ERP</strong></td>
<td></td>
</tr>
<tr>
<td>Number of employees in the IT</td>
<td>75 (20 are the Focal People)</td>
</tr>
<tr>
<td>department</td>
<td></td>
</tr>
<tr>
<td>Type of ERP System</td>
<td>SAP ECC 5</td>
</tr>
<tr>
<td>Implementation (Go Live) Date</td>
<td>January 2005 at Group Finance and Corporate Division May 2003 at CBSC (Malaysia subsidiary) March 2004 at CBSIAV (Thailand subsidiary) April 2006 at CBSIP (Malaysia subsidiary) January 2007 at CBSIE (Malaysia subsidiary)</td>
</tr>
<tr>
<td>Modules Implemented</td>
<td>- Financial Information and Cost Controlling (FI &amp; CO) modules at the Corporate Division (CBCD) - FI, CO, MM (Material Management), SD (Sales and Distribution) and PP (Production and Planning) modules at the subsidiary, that is CBSC</td>
</tr>
<tr>
<td>Implementation Methodology</td>
<td>ASAP (Accelerated SAP)</td>
</tr>
<tr>
<td>Motivating Factors for Adopting</td>
<td>- providing a proper and secure database for business data</td>
</tr>
<tr>
<td>ERP</td>
<td>- having seamless integration of data from all departments</td>
</tr>
<tr>
<td></td>
<td>- having effective communication</td>
</tr>
<tr>
<td></td>
<td>- demonstrating highest level of integrity of corporate governance</td>
</tr>
<tr>
<td></td>
<td>- accelerating business innovations</td>
</tr>
<tr>
<td>Current Situation of ERP Use</td>
<td>SAP mainly used for operational activities Only 60% to 70% of the system capacity exploited Cost hindering expansion to other modules</td>
</tr>
</tbody>
</table>
### IT and ERP

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Item</th>
</tr>
</thead>
</table>
| **Major Benefits** | Cycle time reduction – speed up the job/process, work and managing day-to-day work  
|               | Faster decision making process – SAP also helps in terms of making effective decisions  
|               | Customer service improvement – ease of customer data access and customer inquiries  
|               | Increased IT infrastructure capability – Streamlined and standardised platform  
|               | Create a corporate culture – SAP creates and instils unity among the users through the collaboration between users from different department and subsidiaries  
|               | Support business alliance by efficiently and effectively consolidating the subsidiaries into standard business practice |

*Source: Compiled from Annual Report of 2009–2010 and Interview Sources of Case B (DB1)*

The following section presents the findings on issues and problems encountered by SAP users in CBCD and CBSC.

#### 5.3.3 Problems and Issues in SAP (ERP) System Use

To identify the problems and issues of ERP system usage in Case C, data analysis was carried out through open coding of all interview transcriptions. Analysis of the 13 interviews led to the identification of system, data, technical and interface as the four main problem areas. The analysis also resulted in several sub-categories in each of the four main problem areas. Table 5.12 summarises the selected quotations as exemplars of the problems that the users face.
Table 5.12: SAP Use Problems and Issues in Case B

<table>
<thead>
<tr>
<th>Category</th>
<th>Dimension/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Functionality</td>
<td><strong>Unavailability</strong>&lt;br&gt;Lack of SAP functionality to perform a required task in a timely way (based on ISO EC 9126)</td>
<td>We are unable to generate customised reports using SAP due to the unavailability of the required function. [Finance Manager of CBSC - M20]</td>
<td>7</td>
</tr>
<tr>
<td>System Usability</td>
<td><strong>Non-Learnability</strong>&lt;br&gt;The lack of SAP system inbuilt capability that enables users to learn how to use it (Based on ISO/IEC 9126)</td>
<td>Firstly, I try to coordinate, I try to understand SAP and I try to utilise the SAP system fully.” “… from what I have observed, sometimes the head department have knowledge on the system. But, it is not channelled to their subordinates. This has become the problem since most of the transactions are usually performed by the operational or clerical level. [Group Finance Assistant Manager of CBCD - M18]</td>
<td>6</td>
</tr>
<tr>
<td>System Utilisation</td>
<td><strong>Underutilisation</strong>&lt;br&gt;SAP features have not been fully exploited by SAP users (Jaspersen, Carter &amp; Zmud 2005)</td>
<td>According to the expertise out there, they have come and visited us and they have performed an audit and concluded that we are still not fully optimising the SAP features. So, I can say that we are still far behind….So, basically SAP just helps us to ease some of our burden but it does not take us to a higher level in which we are able to perform further analysis. I mean, what I can say is that the users have not fully exploited the system. [MIS and SAP Senior Manager - M14]</td>
<td>8</td>
</tr>
<tr>
<td>Data Quality</td>
<td><strong>Untimeliness</strong>&lt;br&gt;The recorded SAP data is out of date (Based on Ballou &amp; Pazer 1985)</td>
<td>Data need to be keyed into SAP daily but as for now, I am unable to do it. This is because there is no cooperation between departments. My current practice is to key in the data on a weekly rather than daily basis. [Purchasing and Vendor Development Clerk of CBSC - C26]</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><strong>Incompleteness</strong>&lt;br&gt;Omission of data or missing data entered into SAP (Based on Ballou &amp; Pazer 1985)</td>
<td>I am unable to key in all the required information in SAP and the taxation figure is missing. When I print it out, I am facing this problem from the beginning until now. For example, when I key in five invoices of the car repaired, one of the invoices need to have the detail information in the additional space. Therefore, when I key in the information, it would not appear in SAP. That’s the problem that I have for the payment. [Group Finance Supervisor of CBCD - S19]</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><strong>Inaccuracy</strong> elsewhere (based on Ballou &amp; Pazer 1985)</td>
<td>Normally, the amount in SAP is never the same. It seldom matched, sometimes we have more but sometimes we have less. [Finance Manager of CBSC - M20]</td>
<td>9</td>
</tr>
</tbody>
</table>
### 5.3.3.1 System problems

Three of the system–related issues that came up repeatedly during the interviews are system functionality, system usability and system utilisation. The initial expectation from the implementation of the SAP system was its ability to facilitate and speed up everyday tasks. In addition, SAP was expected to improve overall business processes by producing timely reporting or by detecting flaws in the daily operations. However, some of the interviewees in Case B expressed their disappointment with SAP. For instance, the Assistant Manager of the Group Finance Department (M18) of CBCD believed that SAP did not simplify their work: ‘Personally, I feel that SAP is quite a complex system. This system is not easy to be used and it means that our people would not be able to catch up with whatever is required by SAP.’ Other disappointments are related to the different problems users encounter while using SAP.

One of the common problems in Case B was functional **unavailability** issues, mainly pertaining to the lack of customised reporting functionalities. For instance, both the Finance Manager (M20) and the Assistant Finance Manager of CBSC (M21) argued that the current design of financial statement in SAP is not tailored to their specific needs. The Finance Department in CBSC is required to make a comparison of the financial performance based on either the yearly, monthly or year-to-date figures, or between the actual and budgeted financial figures. Although the data
are available from SAP for comparison purposes, the reporting function is not customisable to achieve the user’s desired outcome. Therefore, to cope with the deficiencies, an Excel spreadsheet is used for reporting purposes. According to the Finance Manager (M20), the Excel and SAP reports are not always consistent as these two reports are stand-alone reports. The Senior Manager of the MIS and SAP Department (M14) of CBCD, who is responsible for ensuring that the SAP system is being fully utilised, also acknowledged the problem:

Basically, encouraging everybody to use the SAP financial report is our mission. However, from what I know, some of the SAP financial reports are not easy to customise. Maybe one day, when everybody has aligned with SAP in doing things, then, we can customise further.

[MIS and SAP Senior Manager - M14]

Another example to illustrate the unavailability issues was brought up by an Assistant Manager of the Finance Department of CBSC (M21). According to her, rather than using SAP to generate the cost per unit (CPU) report, users retrieve the necessary information such as the amount of raw material from SAP and then enter the data into an Excel file to calculate the cost per unit. Excel is utilised for generating CPU reports because CPU reports from SAP are not customisable to users’ requirements. Table 5.13 offers a summary of the system unavailability problems identified from Case B.

### Table 5.13: Examples of SAP Functional Unavailability Problems in Case B

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance Department (CBSC)</td>
<td>The required customised format for generating management report is not available via SAP, which leads to excessive use of Microsoft Excel</td>
<td><em>We are unable to generate customised reports using SAP due to the unavailability of the required function.</em> [Finance Manager of CBSC - M20]</td>
</tr>
<tr>
<td>Finance Department (CBSC)</td>
<td>SAP users need to use Excel for comparing the actual and budgeted financial figure since such a function is not available through SAP</td>
<td><em>We generate monthly financial statements from SAP from which we transform into Excel format. We have to do this because we wanted to make a comparison between actual and budgeted figure of the financial statement. It is not possible to get the comparison figure directly from the system. This is because the financial statement is not yet customised to our requirements.</em> [Finance Assistant Manager of CBSC - M21]</td>
</tr>
<tr>
<td>Where</td>
<td>What</td>
<td>Interview Logs</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Finance Department (CBCSC)</td>
<td>Users believe that SAP does not provide a customised Cost Per Unit (CPU) report generation function</td>
<td>I am not so sure whether we have the function [CPU report generation] in SAP or not. As for now, from what I know, we do not have the customised cost per unit report. We probably have such a function; it’s just that we have never explored that. [Finance Assistant Manager of CBSC - M21]</td>
</tr>
</tbody>
</table>

The second problem is **system usability**, which relates to issues of SAP when a user does not know how to operate and use the system. For example, in the Production Planning and Control (PPC) Department, due to users’ lack of knowledge, they are unable to perform given tasks by using the system. This situation is illustrated in the back flush process.

A back flush process usually occurs at the initial stage of manufacturing the ‘mother part’ during the production of a large automotive component (such as moulding component, impact system, door sash, door-in-white), Case B has to first produce smaller automotive parts. The large automotive component is known as the ‘mother part’, while the small part is known as the ‘child part’. A back flush is a process that involves the transfer of child parts to produce the mother part. The quantity of material back flushed is dependent upon the bill of material (BOM) usage. The system usability (non-learnability) problem related to the back flush process is described in Table 5.14.

An **underutilisation** problem is also discovered in Case B. Table 5.14 outlines some examples of this problem found in the departments of CBCD: MIS and SAP, Group Finance and CBSC (Production, Planning and Control). Some of the respondents suggested that the underutilisation problem occurred when SAP users do not exploit the SAP system functionalities. This is particularly the case with advanced SAP functionalities for decision making, planning of material, and for treasury functions.
### Table 5.14: Examples of System Usability and Underutilisation Problems

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
<th>M14</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIS and SAP Department (CBCD)</td>
<td>The SAP users do not learn to use this system very quickly</td>
<td><em>I believe that I have given sufficient training to users but what I have discovered is that some of the users are still not capable of using the system.</em> [MIS and SAP Senior Manager - M14]</td>
<td></td>
</tr>
<tr>
<td>Finance Department (CBSC)</td>
<td>Some users do not like to use SAP frequently</td>
<td><em>Okay, we just discovered that the Production Planning staffs do not perform the back flush process properly; they have to do it correctly. This means that they needed to highlight to the SAP team when there is any deficit or access of back flush. They cannot simply ignore it! What happens now is that they just ignore any back flush problem and continue to process it.</em> [Finance Assistant Manager of CBSC - M21]</td>
<td></td>
</tr>
<tr>
<td>Group Finance Department (CBCD)</td>
<td>Users feel that they need to learn a lot of things before they can get going with SAP</td>
<td><em>Firstly, I try to coordinate, I try to understand SAP and I try to utilise the SAP system fully. … from what I have observed, sometimes the head department have knowledge on the system. But, it is not channelled to their subordinates. This has become the problem since most of the transactions are usually performed by the operational or clerical level.</em> [Group Finance Assistant Manager of CBSCD - M18]</td>
<td></td>
</tr>
<tr>
<td>MIS and SAP Department (CBCD)</td>
<td>Advanced SAP features are not fully utilised for improving work and for decision making</td>
<td><em>According to the expertise out there, they have come and visited us and they have performed the audit and somehow concluded that we are still not fully exploiting the SAP features. So, I can say that we are still far behind; we are using the basic modules just to help us in easing our daily routine such as compiling the report, extracting the data and ease in the complexity of the integration between the financial site and the logistics site. Therefore, SAP just helps us to ease some of our burden but it does not take us to a higher level in which we are able to perform further analysis. I mean, what I can say is that these users have not fully appreciated the system for decision making purposes.</em> [MIS and SAP Senior Manager - M14]</td>
<td></td>
</tr>
<tr>
<td>MIS and SAP Department (CBCD)</td>
<td>Underutilisation problem of SAP system</td>
<td><em>In terms of percentage wise, I would say that close to 30% of SAP functionalities have not been exploited.</em> [MIS and SAP Senior Manager - M14]</td>
<td></td>
</tr>
<tr>
<td>Group Finance Department (CBCD)</td>
<td>SAP Treasury function underutilised</td>
<td><em>SAP has a treasury function that has been used by an ex-employee in Finance. However, the problem was that she did not update it. As we need to close off the balance from this function, it would trigger adjustments in terms of interest and others. Therefore, we did not utilise the treasury function of SAP.</em> [Group Finance Assistant Manager - M18]</td>
<td></td>
</tr>
<tr>
<td>Production Planning and Control Department (PPC)</td>
<td>Underutilisation of SAP’s Material Resource Planning due to fluctuation of production volume</td>
<td><em>There is a Material Resource Planning (MRP) function in the system, but we did not utilise it. Since the source of the information in terms of the production volume is derived from our customers, therefore, it is quite complicated to use the MRP function. This is due to the changes of production volume that was based on the estimation figures only.</em> [Production Planning and Control Executive - E22]</td>
<td></td>
</tr>
</tbody>
</table>
5.3.3.2 Data quality problems

Data quality problems uncovered are the untimeliness, inaccuracy and incompleteness of SAP data. The **untimeliness of data** is best exemplified through the receiving process. In the receiving process of the CBSC, the Purchasing and Vendor Development Department provides a list of purchase orders (PO) to the Production Planning and Control Department at the commencement of each month. Then, a copy of the PO list is sent to a Production Planning Control supervisor. Once the goods arrive at the receiving unit (part of the Purchasing and Vendor Development Department), the actual goods are compared with the delivery notes (DN) from the supplier to ensure that the quantities of the actual stock match the delivery notes. Next, the receiving clerk keys the data into the SAP system on a daily basis.

However, this process and the timelines are not strictly followed. Usually, there is a delay in entering the data into SAP and data entries are collectively done on a weekly basis. This delay results in a setback in generating updated stock information. This time lag in recording the inventory is a critical issue since it is reflected in discrepancies between the actual and the SAP stock amounts. Moreover, it is also crucial for the Purchasing and Vendor Development Department to get timely inventory information because frequent stocktaking indirectly disrupts the flow as well as the consistency of information delivered throughout Case B.

This problem originated from users' lack of discipline (described in detail in Section 5.3.4.2). A Senior Manager of the MIS and SAP Department (CBCD) remarked:

> Users have to discipline themselves to key in the data in a timely manner. Say, they need to key in the Goods Received immediately so that it must be in a real time basis. Otherwise, it will affect the related process. However, practically it does not happen. It is not good and not really up to the required level.

[MIS and SAP Senior Manager - M14]
Table 5.15: Examples of Data Untimeliness Problems in Case B

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchasing and Vendor Development Department (CBSC)</td>
<td>SAP data do not reflect timely daily stocks as data are entered weekly</td>
<td><em>Data needs to be keyed in into SAP daily but as for now, I am unable to do it. This is because there is no cooperation between departments. As for now, to fulfil my job scope in order to close the transaction at the end of every month, my current practice is to key in the data on a weekly rather than daily basis.</em> [Purchasing and Vendor Development Clerk - C26]</td>
</tr>
<tr>
<td>Production, Planning and Control Department (CBSC)</td>
<td>Stock data in SAP are not timely, which leads to <em>ad hoc</em> stocktaking that disrupts the flow of receiving goods</td>
<td><em>We need immediate information when goods are received. However, when there is a delay in the process, we need to do another stocktake. The frequent stocktaking indirectly disrupts the smoothness of transaction flow especially for the goods receiving process.</em> [Production Planning Control Supervisor - S23]</td>
</tr>
<tr>
<td>Production, Planning and Control Department (CBSC)</td>
<td>The purchase order information in SAP is not timely</td>
<td><em>Things need to be done on time. For example, we should first prepare the purchase order (PO) prior to Goods Receive Notes (GRN). We need to do the data entry of all of these documents on a timely basis. The problem is that our staffs do not key in the PO information on time [prior to the commencement of new month].</em> [Production Planning Control Executive - E22]</td>
</tr>
<tr>
<td>Production, Planning and Control Department (CBSC)</td>
<td>Sometimes production is planned based on untimely SAP data</td>
<td><em>The information is not received on time. For example, <em>Bill of Material (BOM)</em> should be received on time during the development stage for a new model [car] but usually we receive it after the mass production stage. For instance in the ALZA’s project; the mass production started since Nov 2009. However, we are still unable to key it in into SAP.</em> [Production Planning Control Supervisor - S23]</td>
</tr>
</tbody>
</table>

In addition to the untimeliness of SAP data, data incompleteness is encountered in the Group Finance Department of CBCD and in the Finance Department of CBSC. In the first example, when the Finance Supervisor (S19) wanted to print out the invoices, she found out that the taxation information was not captured by the system, though she had already keyed the figure into SAP.

I am able to key in all the required information in SAP but the taxation figure is missing. When I print it out, I am facing this problem from the beginning until now. For example, when I key in five invoices of the car repaired, one of the invoices needs to have the detail information in the additional space. So, when I key in the information, it won’t appear in SAP. That’s the problem that I have for the payment. [Finance Supervisor - S19]
In the second case, incompleteness of data was found during the back flush process in CBSC. The process of back flush is described in Section 5.3.3.1. During the back flush process, all the items required to produce the mother part should be captured in SAP. A Finance Manager of CBSC (M20) had the following to say:

The first step in the back flush process is to do the transfer posting [which sources of the raw material are to be used]. However, if the user skips some of the steps, it will affect the overall process. For example, if we wanted to produce 50 pieces of the automotive manufacturing parts, the staffs need to key all the items [child parts items] into the system. From this, SAP would generate the list of Bill of Material [BOM]. Say, in producing 50 pieces of the mother part, it may require five child parts. These child parts are taken out from the different storage. The transferring process is known as the back flush process.

[Finance Manager - M20]

The usability problem occurs when the Production Planning and Control staff does not perform their tasks properly during the back flush process. Since they do not like to use the SAP system frequently, they intentionally avoid keying in the child part items (because the items are usually given free by the supplier). As a result, the store person does not transfer the child parts to the Production Planning and Control Department. Hence, there are no ‘parts’ to be produced physically. However, in the SAP system, the data shows the production of the parts. To add to this problem, the staff from Production Planning and Control fails to notify the SAP team about the discrepancies of the child parts and proceed with the back flush process. Consequently, this leads to incompleteness and inaccuracy problems of the SAP data.

According to the Finance Manager of CBSC (M20), data incompleteness problems occur when the receiving staff does not key in some of the automotive parts and, at the same time, the storekeeper fails to transfer the stock to the production. This implies that no parts are being produced in the production department, although the data exist in the system (SAP). He elaborated: ‘From the five automotive component parts to be issued, say item no. 4 is not in the store. Therefore, it is impossible to produce this one part without part no. 4. So, the receiving staffs are likely to zerorise this in the system.’ Failure by the receiving staff to key in the accurate amount of the child part contributes to the incompleteness problem, as explained by the finance manager (M20) of CBSC:
SAP will recognise the few items [small parts] that are needed to build the mother part, but sometimes these items are omitted. Actually, these items were already included during the operation but it is not reflected in the system.

[Finance Manager - M20]

And the comment from the assistant manager (M21) from the same department:

Something is missing when we execute the transaction. Sometimes the system can allow that process…. The data is already in the system, whenever we want to produce one single part, the system already have its component. I think they call it as back flush. So, after we assemble this part to be one part and when we do back flush, supposedly SAP is able to capture the items but unfortunately, there are line items when we do back flush. We have to key in each of the small parts into SAP.

[Finance Assistant Manager - M21]

Untimely and incomplete data make the data inaccurate. In addition, the interviews identified a number of incidents of data accuracy problems in managing BOM for the back flush process, a posting process that transfers the material used (child parts) to produce the large automotive components (mother parts), for paying vendors, and for production planning. For example, in the receiving unit of the Production Planning and Control Department, some of the receiving clerks do not input all data received from the suppliers, especially items that are received free of charge during the back flush process are not recorded. Consequently, the inaccurate data entered into the SAP system have an impact on subsequent processes such as Goods Transfer and lead to discrepancies between the quantity of physical stock and the quantity of back flush in SAP. A Production and Planning Supervisor (S23) noted:

During the receiving process, we accept the free of charge [FOC] items together with the inventory. For example, our customer usually delivers the CKD [an automotive components part] freely. Since there is no cost involved, some users feel that it is not important for them to key in the data into SAP. However, they forget that this will affect the later process like the Goods Transfer. We cannot do the Goods Transfer process on time because the data is not accurate any more.

[Production and Planning Supervisor - S23]
In the Finance Department of CBSC, inaccuracy of SAP data for costing BOM has led to the adoption of manual processing. The cost of back flush is usually underestimated due to the mismatch between the SAP data and the actual inventory. Hence, the finance manager (M20) believes that the account balance is also affected as the underestimation of cost (from the back flush process) leads to an overestimation of the overall profit. This result would not portray the true picture of CBSC’s financial position. In order to amend this situation, the manager has to opt for manual data processing. Yet the disadvantage of manual processing is that it has defeated the purpose of the ERP (SAP) system implementation of having a fully automated system to speed up the business processes. Besides that, manual processing is not able to show the actual raw material cost:

The problem with manual processing is that it does not assign the relevant cost during the back flush... So, when we do it manually, we are only able to get the purchasing cost but not the raw material cost.... Normally, the amount in SAP is never the same. It seldom matched, sometimes we have more but sometimes we have less.

[Finance Manager of CBSC - M20]

The second example to illustrate the inaccuracy of data is found in the Production and Planning and Control Department and is associated with over payment of suppliers. Production Planning and Control staff have frequently keyed in the same Purchase Order (PO). According to the Supervisor of Production Planning and Control (S23), as a result of this duplication of SAP data entry, overpayment has been made to their suppliers: ‘For example, within the past two months, when I made some reconciliation, I found that there are many triple key-in for one Purchase Order. This means that we have overpaid our suppliers.’ The redundancy of the data entry is caused by a weak control mechanism in CBSC. This is discussed in detail in Section 5.3.4.

Thirdly, data inaccuracy problems in SAP have an impact on the planning process of Case B. At present, the MRP (Material Requirement Planning) function in SAP cannot be utilised since the recorded SAP stock quantity is not accurate. The planning process is carried out by the Planning Section of the Production Planning and Control Department. This process starts when the Production Planning and Control Supervisor (S23) receives the forecast volume from customers. Then, he calculates planning for ordering by using an Excel spreadsheet. Next, he creates the material forecast order (MFO). This is followed by issuing the Purchase Order and other related purchasing processes. Ideally, the MFO should be created through MRP in SAP. In CBSC, the planning of material through MFO is carried out by using an Excel template rather
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than an MRP function. A statement by a Production Planning and Control Executive (E22) suggested that even though the function is available, they have difficulty in performing the planning process through MRP (SAP) due to the inaccurate stock data in SAP.

Our stock is not accurate, what I mean is that the actual stock is not similar with the stock recorded in SAP. Okay, what I could say is that the users do not have discipline. Sometimes, they are two weeks delayed in recording the stock. Therefore, if we want to run MRP, it is quite difficult because MRP will read the actual stock in the system. That’s why we cannot do it through the system.

[Production Planning and Control Executive - E22]

5.3.3.3 Technical infrastructure problems

Technical infrastructure issues are the least identified of the problems that have hampered SAP use by end users in Case B. Technical problems pertain to IT infrastructure issues such as the hardware, servers and services used across Case B. The interviewees reported on the slow networking and server issues that impede the effectiveness of the ERP system and the transaction processing period. From the comment made by a Purchasing and Vendor Development Department Assistant Manager (M25):

The system itself is quite slow; it has to do with the server. So, if we need to process the transaction urgently, sometimes we cannot do it through SAP. How are we going to proceed if the server hangs or becomes too slow? We always have this problem.

[Purchasing and Vendor Development Assistant Manager - M25]

The Manager of the MIS and SAP Department (M15) agreed partially: ‘We are facing occasional problem with the network… At our site, we have to take care of the network, firewall and communication line to make sure that user can use the system efficiently but it is quite difficult to say since it is not a regular problem.’

5.3.3.4 Interface problems

The main interface issues reported by a number of interviewees are the poor SAP screen and the unfriendly interface design (Table 5.16). Some of the interviewees also spoke about poor SAP design such as the unavailability of adequate space for characters in some of the SAP
column fields. For instance, in the Group Finance Department (CBCD), all required information should be included (inclusive of the taxation figures) while processing a payment voucher. However, the existing SAP screen does not permit users to key in detailed taxation information, which generates inaccuracy of the SAP report.

Another example of an interface issue is users’ need for a more user-friendly interface. The complexity of the existing interface design, which has many fields to be filled, is considered problematic, especially for novice users, who require a friendlier interface and screen design. Users believe that they have to execute tedious and sometimes needless actions to arrive at a desired outcome. When users compare the SAP screen designs with other applications (such as Oracle or IBM application), SAP’s interface design is considered complex and difficult to operate. On the other hand, the Assistant Manager of the Purchasing and Vendor Development Department (M25) has a different opinion. He believes that the SAP system is quite user friendly and that it depends on the user themselves. He added that what is important is that the users are knowledgeable enough and are able to accomplish their tasks. He stressed that the problem is not the SAP system interface but users’ attitudes, which delay the transaction processing.

Table 5.16: Examples of Interface Problems of SAP in Case B

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Group Finance Department (CBCD)</td>
<td>Some users find that some of the SAP input fields are limited in length and do not accommodate the full detail of the entity</td>
<td><em>I have a problem with the SAP screen, which is not customised to my needs. For example, the restricted layout for taxation column. The space allocated for the character is limited to only 50 words but when we need to print out the payment voucher, I need to key in the detail information on the payment. However, due to poor screen design of the space character in SAP, I was not able to key in all needed detail. This resulted in the taxation figure not being captured in the system.</em> [Group Finance Supervisor - S19]</td>
</tr>
<tr>
<td>MIS and SAP Department (CBCD)</td>
<td>The SAP screen layout is perceived by some end users as too excessive with irrelevant fields</td>
<td><em>Yes, I must admit that sometimes the SAP screen is a little bit overkill. In a sense that it has so many fields that are not supposed to be there in the first place.</em> [MIS and SAP Senior Manager - M14]</td>
</tr>
<tr>
<td>Production Planning and Control Department (CBSC)</td>
<td>SAP screen design perceived as unfriendly and awkward to use</td>
<td><em>The SAP screen seems awkward at first, but then once you are already used to it, you will enjoy using it especially the tracking part.</em> [Production Planning and Control Executive - E22]:</td>
</tr>
</tbody>
</table>
Overall, the SAP system usage problems identified comprise system unavailability, usability and underutilisation; the untimeliness, inaccuracy and incompleteness of data; and technical infrastructure and interface problems. These problems do not occur in isolation and they have inherent relationships. The relationships between these problems are exhibited in Figure 5.8.

**Figure 5.8: Diagram Showing the Relationships between ERP Usage Problems in Case B**

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance Department</td>
<td>The complexity of SAP interface design compared to other application</td>
<td><em>The system itself is quite complicated. The interface is not that user friendly. Other systems are easier to understand and straightforward. Though the system is reliable, it is quite complicated and difficult to understand as well as to operate it.</em> [Finance Assistant Manager of CBSC - M21]</td>
</tr>
</tbody>
</table>

Notes:

- **Affect/ leads/makes** : Lead to/ cause (direct relationship) – one problem lead to the other problem
- **Aggravates** : Heighten/worsen/ exacerbate – one problem heighten the other problem
- **Influences/ Contributes** : Indirectly affect – one problem mediate the other problem
5.3.4 Antecedents of ERP Usage Problems

Organisation, user, task and technology categories of causal factors have been found. A summary of these antecedent factors, their definitions and sample interview logs is provided in Table 5.17.

### Table 5.17: Factors that explain the Antecedents of SAP Problems and Issues in Case B

<table>
<thead>
<tr>
<th>Category</th>
<th>Dimension/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organisation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Inadequate Training | The insufficient amount and quality of specialised instruction and practice that is given to the user to increase the user’s proficiency in ERP usage (Based on Wu & Wang 2007, p. 1594) | Okay, from what I had experienced during my six months of experience here, I have never come across any specific training on SAP. I have never been told, I have never been invited and I believe that none of my staffs have been trained for the last 6 months.  
[Finance Manager of CBSC - M20] | 10                                   |
| Lack of Funds | The unavailability of money to finance the SAP system (based on Behrens & Sedera 2004, p. 1712) | Back to the basics when we want to change anything, it involves more budgets. I am not sure as to why we use the system if no additional budget is available to maintain it.  
[Production Planning and Control Supervisor - S23] | 6                                   |
| Lack of Support | The lack of technical expertise from the support team (based on Ewusi-Mensah 1997) | I do not believe that the internal consultants are able to provide all the knowledge required. Sometimes when we face a problem and we need their help, they are not there to support us.  
[Finance Manager of CBSC - M20] | 7                                   |
| Lack of Control | Lack of coordination activities within a work system that affects the smoothness of operations and disrupts the accomplishment of tasks via SAP (based on Wäfler et al. 2011, p. 204) | For the internal production, we are required to key in the list of internal material used for the operation. Meanwhile, someone (say from Purchasing Vendor Development Department) needs to key in the purchase part that they bought from outside. This process is crucial to enable the back flush process. Due to this requirement, I have to share the same ID with the user from the Purchasing Vendor Development Department. We are aware that that this is an unauthorised practice, yet it has frequently occurred in the past.  
[Production Planning and Control Clerk - C24] | 8                                   |
<table>
<thead>
<tr>
<th>Category</th>
<th>Dimension/Definition</th>
<th>Sample Interview Logs</th>
<th>No. of Similar Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User</strong></td>
<td><strong>Lack of Individual Strength</strong>&lt;br&gt;Level of conviction about the users’ judgment and confidence with regard to their ability to use and perform various tasks in SAP (based on Compeau &amp; Higgins 1995)</td>
<td><em>I would say it is not because our operators never use the computer but sometimes we are afraid to use it. When we started using SAP, we were scared to explore further. Let’s say, if I save this transaction, what would happen next, what is the impact? Our lack of confidence limits us from further exploring this system [SAP].</em>&lt;br&gt;[Purchasing and Vendor Development Clerk - C26]</td>
<td>11</td>
</tr>
<tr>
<td><strong>Lack of Awareness</strong>&lt;br&gt;Lack of SAP user’s attentiveness to how their tasks will be completed by using SAP (based on Gutwin et al. 1995)</td>
<td><em>We must emphasise the importance of the SAP system and not the production alone. What happens is the lack of sensitivity and awareness on the importance of the SAP system.</em>&lt;br&gt;[Purchasing and Vendor Development Assistant Manager - M25]</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Affordance</strong>&lt;br&gt;The functions and operations that are provided by SAP (based on Behrens &amp; Sedera 2004, p. 1720)</td>
<td><em>We are supposed to compare between actual and budget figures but the report is not available in SAP. Although we can compare the financial result based on month or year, it is not what we require. SAP is unable to customise our needs.</em>&lt;br&gt;[Finance Assistant Manager of CBSC - M21]</td>
<td>6</td>
</tr>
<tr>
<td><strong>Task</strong></td>
<td><strong>Task interdependence</strong>&lt;br&gt;The degree to which sub-units must exchange information or material in order to complete their tasks by using SAP (based on (McCann &amp; Ferry 1979)</td>
<td><em>It is quite difficult for me to key in the data every day without the cooperation from other departments. This is quite a major issue since it will affect the whole process in the organisation. Data needs to be keyed into SAP daily but as for now, I am unable to do it. This is because there is no cooperation between departments.</em>&lt;br&gt;[Production Planning and Control Clerk - C24]</td>
<td>8</td>
</tr>
</tbody>
</table>

5.3.4.1 **Organisational factors that contribute to ERP use problems in Case B**

The organisational factors that lead to SAP usage problems are **inadequate training, lack of funds, lack of support** and **lack of control**.
Inadequate Training

To facilitate the development of skilled people, organisations using ERP must invest in training. Training is important during the early implementation and the post-implementation phases of ERP. The findings from Case B suggest that, despite the enormous efforts by the MIS and SAP Department, end users perceive that the training is insufficient, particularly in terms of refresher and ongoing training and the comprehensiveness of the content. Firstly, refresher training is viewed as being crucial to retain the previous knowledge and skills acquired by users and to increase their skills, thereby enabling them to use the system for day-to-day operations. A Finance Manager of CBSC stressed this as ‘there should be frequent training first to update any new development and, second, to refresh anything that we have learnt.’ (M20)

The interviewees from both CBCD and CBSC frequently cited the lack of refresher training. While some of the participants felt that they were adequately trained, others expressed frustration because they had needed to learn the system themselves or from their colleagues. For example, users of the Material Management modules (MM) highlighted their disappointment on the status of training for this module. To quote from an Assistant Manager of the Purchasing and Vendor Development Department (M25): ‘The last training was held in 2003. There is a seven year gap already as it is now 2010. It is quite some time since we last received our training for the MM module.’

To add to this, a Finance Manager of CBSC reflected on his experience concerning the lack of refresher training: ‘Okay, from what I had experienced during my six months of experience here, I never came across any specific training on SAP. I have never been told, I have never been invited and I believe that none of my staff have been trained for the last six months.’ (M20)

Secondly, in Case B the training was also perceived as not sufficiently comprehensive. This refers to the content of the initial SAP training, which users perceived as too general. Most interviewees felt that the training offered was introductory knowledge of the specific modules and tasks, thus leaving them to learn the SAP system through their own experience. An Assistant Manager of the Purchasing Vendor Development Department (M25) spoke about the content of the existing training:

We do train our staff but it is more of on-the-job training. The training is not adequate or up to date. We need to provide them with sufficient training. We need to monitor them
closely... The training given specifically on the Material Management module is not comprehensive.

[Purchasing and Vendor Development Assistant Manager - M25]

Examples of the impact of inadequate training are demonstrated in various processes such as the backflush, and the delivery and receipt of goods procedures, where SAP users are unable to decide on the important steps and information to be entered into the system, consequently jeopardising the SAP data quality. For instance, when a clerk in the Purchasing and Vendor Development Department (C26) entered incomplete data in the stocktake process, it triggered a disparity between the actual amount of stock and the amount recorded in SAP.

In order to use SAP more effectively, we need an executive level and above to monitor our work. For example, I require some training for the stock taking process; otherwise I tend to skip some of the required steps for this process, which affects the quality of the SAP data.

[Purchasing and Vendor Development Clerk - C26]

Inadequate investment in training also leads to a lack of users’ understanding of the system, which, in turn, affects their individual strength. A supervisor of the Production Planning and Control Department (S23) stated: ‘Since we do not have adequate training, we lack knowledge on how to use the system. I do not want to be emotional but I would say that I learnt SAP the hard way.’ In addition, the same supervisor mentioned the cause of the lack of training:

In our case, if we want to provide the training, we would require more funds and it is costly. That is why the management do not want to invest more in training.

[Production Planning and Control Supervisor - S23]

Lack of Funds

The availability of sufficient funding is viewed as crucial to train SAP users to ensure that they are utilising the SAP system to perform the required job functions. However, adequate investment in training is often neglected in Case B and, at times, critically underfunded. Thus, the limitation of the budget for training has aggravated the data-related issues of SAP. The Production Planning and Control Supervisor (S23) expressed his frustration concerning the management’s response regarding the additional funds needed for training:

Back to the basics when we want to change anything, it involves more budgets. In our case, if we want to provide the training, we would require more funds and it is costly.
That is why the management do not want to invest more in training. As for me, I feel SAP seems floating. I am not sure as to why we use the system if no additional budget is available to maintain it.

[Production Planning and Control Supervisor - S23]

To illustrate this point further, an Assistant Manager of the Purchasing and Vendor Development Department (M25) had requested additional training for the Material Management module. Unfortunately, the training was not available due to budget constraints. As the cost of hiring an external consultant reaches up to AUD332 (RM1,000) per day, it was considered too costly by the management team. Inadequate funds allocated for training affected the SAP users from this department since they have still not mastered the MM module. In addition, the inadequate funds invested in training have led to SAP data inaccuracy. The SAP users are less knowledgeable in the MM module due to lack of training. This is evident through their ignorance about keying in the ‘free of charge’ (FOC) items received during the back flush process, as described in the data inaccuracy issue section (see Table 5.17 for details).

Lack of Support

Although three internal SAP experts are available in both CBCD and CBSC, this number is inadequate, as the SAP experts need to cater for the whole group of Case B. Having only 75 IT personnel employed to address IT related matters internally presents an obstacle to providing immediate technical support when needed. A Finance Manager of CBSC (M20) commented on the lack of technical support services received from the internal experts: ‘There are only three internal consultants overseeing the whole group. So, it is not sufficient. Sometimes when we face a problem and we need their help, they are not there to support us.’

The Assistant Manager of Group Finance from CBCD (M18) reinforced this:

We do not have enough support from our internal consultants. There are three personnel who are directly in charge of SAP. However, the problem is that they manage the whole group. Besides, usually they do not stay put here. They are mobilised to other subsidiaries around Malaysia and the Asian region. Sometimes they go to Thailand to provide SAP technical support over there. This has become a problem to us, since we cannot get immediate help when required.

[Group Finance Assistant Manager - M18]
The lack of technical support aggravates the untimeliness and inaccuracy of data. To illustrate this relationship, an Assistant Manager of the Purchasing Vendor Development Department (M25) described the discrepancies between the actual quantity and the recorded amount of inventory in SAP. The quantity of goods is supposed to be recorded as 186,000 but the amount of only 60,000 is keyed into the system. Failure to obtain assistance from the internal SAP expert to investigate the root cause of the problem resulted in a delay of the transaction processing as well as the inaccuracy of the SAP data.

In addition, an internal consultant’s ability to transfer technical knowledge to users affects users’ confidence and skills in using SAP. This is shown in a remark from an Assistant Manager of the Group Finance Department (M18) of CBCD: ‘When Nani [our staff] faces a problem with SAP, she usually asks for help from our internal consultant. He [the internal consultant] usually tries to solve the problem himself, rather than train our staff to solve the issues raised.’

**Lack of Control**

Similar to Case A, Case B experiences loose control of access security and lack of segregation of duties. First, each user is assigned a unique username and password created by the MIS and SAP Department to ensure that each user holds the right privileges to access data and processes in the system. Nevertheless, in the Finance, Production Planning and Control Department and the Purchasing and Vendor Development Department, sharing a user ID is considered an acceptable norm. A clerk from the Production Planning and Control Department (C24) stated:

> For the internal production, we are required to key in the list of internal material used for the operation. Meanwhile, someone, say from the Purchasing Vendor Development Department, needs to key in the purchase part that they bought from outside. This process is crucial to enable the back flush process. Due to this requirement, I have to share the same ID with the user from the Purchasing Vendor Development Department. We are aware that that this is an unauthorised practice, yet it has frequently occurred in the past

[Production Planning and Control Clerk - C24]

The sharing of ID creates a risk when SAP users alter the quantity of the stock items without approval from the authorised personnel of the Production Planning and Control Department. This leads to inaccuracy of SAP data, as described by an Executive from the Production
Planning and Control Department (E22): ‘Sharing of passwords is unavoidable, it has become a common practice in this company, but there are problems when the production staffs have entered the incorrect amount of stock for the back flush process. In this situation, it is quite difficult to pin down who should be responsible for the mistakes.’

The practice of sharing a SAP ID persists even though it jeopardises the accuracy of the SAP data. This is intended for cost-saving purposes, as elaborated by the same Executive (E22): ‘I know it is quite difficult to eliminate the sharing of ID since it is a long practice in our company, and, furthermore, additional costs would be involved. When it comes to cost, the management would become sceptical about it.’

Secondly, lack of control in Case B is associated with the absence of segregation of duties. The typical functions that should be separated are authorisation, recording and custodial activities. Effective segregation of these duties is an essential component of any internal control system. In the Purchasing and Vendor Development Department of CBSC, because of the lack of segregation of duties, a clerk is responsible for raising a Purchase Order as well as posting it into the system. According to the Manager of the Finance Department of CBSC (M20):

The Purchasing Vendor Development Department is unlike us. We have a specific clerk to park the transaction and our executive is responsible to post it into SAP. But, for the Purchasing Vendor Development Department, the same clerk has to process as well as post the Purchase Order into SAP. There is neither counter checking nor a filtering process there.
[Finance Manager - M20]

The absence of an adequate control mechanism sparks some concern regarding the accuracy of data generated for the monthly financial statement. Problems range from underestimation of cost to incorrect pricing owing to the lack of overview and control mechanisms.

I believe the root of this problem is because there is no proper monitoring mechanism.... I do not think there is a specific monitoring mechanism in place. I do not think that there is any, because, since I’ve come here, a lot of problems have emerged like lower cost consumption and haywire on price.
[Finance Manager - M20]
Figure 5.9 depicts the influence of organisation factors – inadequate training, lack of funds, lack of support and lack of control – on ERP system usage problems.

**Figure 5.9: The Influence of Organisational Factors on ERP Usage Problems in Case B**

Notes:

- **Affect/leads**/ Makes: Lead to/ cause (direct relationship) – one antecedent factor leads to one problem/ another antecedent factor
- **Aggravates**: Heighten/worsen/ exacerbate – one problem heighten the other problem
- **Influences**: Indirectly affect – one problem/ or antecedent factor mediate the other problem/ or antecedent factor

5.3.4.2 **User-related factors that contribute to ERP use problems**

The analysis of the findings revealed two main user-related factors in Case B: *lack of awareness* and *lack of individual strength*. 
Lack of Awareness

Lack of awareness refers to the user’s level of attentiveness to SAP’s functionality and utility (see Table 5.17 for detailed definition). An Assistant Manager of the Finance Department in CBSC (M21) suggested that the problem associated with erroneous data entry in the Material Management module that impact on the Cost Controlling module is due to the user’s lack of awareness concerning the relationship between these modules. Since SAP users are not attentive to the influence of the material management module on the generation of the financial statement, incorrect data can be entered. For example, users should not post ordinary expenses to the Asset under Construction (AUC) account because the AUC account is intended for a new car model and should be capitalised only once mass production begins. Nevertheless, the practice of posting directly to the AUC account is common and affects the monthly financial reporting. An Assistant Financial Manager of CBSC (M21) stated:

> My work is related to the material management modules. The users of this module [MM module] lack awareness. From my observation, they just do their work for the sake of it. They do not really understand the impact of their work on the financial report.
> [Financial Assistant Manager - M21]

Another example to illustrate lack of awareness was cited by an Executive of the Production Planning and Control Department (E22). He mentioned: ‘The new staffs do not know what to do when they are given some work. That is why we said it relates to discipline. They probably do not have enough knowledge to use the system. There are even times when they are knowledgeable and know their job responsibilities but they do not do their work.’

A Purchasing and Vendor Development clerk’s experience suggests that lack of awareness has led to both the underutilisation of the stock variance function and the preference for Excel for getting approval for any stock discrepancies. He said:

> I am not sure whether the stock variance function is available in SAP. As for now, we have never explored it. Even when I asked the previous staff, they would say that we must get an approval from management by using Excel, before keying into the system.... The manager and executive would prefer to authorise the stock variance from Excel and then transfer to SAP.
> [Purchasing and Vendor Development Clerk - C26]
Lack of Individual Strength

A number of interviewees drew attention to the extent of a user’s individual strength and confidence related to SAP knowledge or skills. Greater computer self-efficacy contributes to a user’s perception of their ability to use SAP effectively. While an Assistant Manager from the Group Finance Department of CBCD (M18) stressed the need to have the prerequisite computer skills prior to SAP system deployment, an Executive from the Production Planning and Control Department (E22) urged the need for advanced software knowledge instead of only basic knowledge:

I do not think it is adequate to know and use the common softwares like Excel, Microsoft Word and others. The SAP system is quite different from this software. If users are not familiar with the computer, it will take a longer time to complete a certain task in SAP. With advanced computer knowledge, the user will be more confident to use SAP. That is what we are lacking now.

[Production Planning and Control Executive - E22]

A user’s lack of confidence has been recognised as one of the factors that discourage them from exploring the SAP system and that, hence, leads to system underutilisation. A statement from a clerk of the Purchasing and Vendor Development Department (C26) was:

I would say it is not because our operators never use the computer but sometimes we are afraid to use it. When we started using SAP, we were scared to explore further. Let’s say, if I save this transaction, what would happen next, what is the impact? Our lack of confidence limits us from further exploring this system [SAP]... we can learn it by ourselves but we are not too confident about what we have done.

[Purchasing and Vendor Development Clerk - C26]

Thus, the operators in her department do not have enough courage to use SAP beyond their learning scope, and are reluctant to discover other functionalities offered by the SAP system even when mistakes occur. ‘We do not dare to reverse the transaction because we are afraid of its impact on other processes.’ (C26).

Lack of individual strength influences SAP system usage. The situation intensifies when knowledgeable users leave the organisation and others have to fill in.

Previously, the person involved in Finance Information (FI) Module was Puan Ami. Since she left the company, I have to replace her. Actually, I am supposed to look at the SAP
in detail but I have difficulty in understanding this system. I am not saying that SAP is not good; it is just that I have little knowledge of SAP. That’s about it!

[Group Finance Assistant Manager - M18]

An Assistant Manager of the Finance Department (M21) from CBSC also shared her experience of dealing with the SAP system. She conceded that the main reason for the system underutilisation and data untimeliness in this subsidiary company is the user’s lack of individual strength. She said:

Like myself, I need to replace the manager who resigned. However, my predecessor did not properly hand over the work to me as he had already resigned. There was nobody here to teach me when I first started working here. I just rely on my staff, Misa, but she also has her own work to do. I am not confident enough to use the SAP system.

[Finance Assistant Manager - M21]

A user’s lack of individual strength also results in the untimeliness of SAP data. An example can be seen in the delay in transaction processing, such as during the receipt of goods (known as MiGO). In the MiGO process, the Production Planning and Control staff needs to enter delivery notes from the suppliers to the system. Therefore, they must know how to record the delivery notes received into SAP. The inability of the end user in executing some transactions like MiGO affects the timeliness of the SAP data. An Executive from this department commented:

Usually, if users do not have knowledge in SAP, there is a delay in operating the system. If they are familiar with SAP, it is much easier for them to do their work. This is why we emphasise users’ computer experience during the hiring of our new SAP clerk.

[Production Planning and Control Clerk - E22]

From the quotations and examples above, it is noted that users’ lack of individual strength plays a role in system underutilisation and untimely SAP data.
To sum up, Figure 5.10 captures the relationships between user-related factors (lack of awareness and lack of individual strength) and SAP usage problems.

### 5.3.4.3 Technology-related factors that contribute to ERP use problems

Technology **affordance** is one of the main factors that contribute to the system functionality (unavailability) problem leading to a wider use of other coping mechanisms such as Excel. In one example, an Assistant Manager of Finance in CBSC (M21) reported the use of Excel for Budget comparison since the function is not available in SAP: ‘We are supposed to compare between actual and budget financial figures but the report is not available in SAP.’ (M21). Lack of SAP affordance also affects the ‘creditors ageing function’, which is not customised to user needs. Hence, SAP users need to rely on Excel to cope with the deficiencies of the SAP system.
According to an Assistant Manager of the Group Finance Department of CBCD (M18), detailed information such as the purchase order number, taxation figure, and any adjustments made and other relevant information could be easily added into the customised Excel Creditor Aging:

We cannot get the detailed information of the creditors aging from the SAP report. If we use SAP, we can only view the total amount of suppliers but would not be able to get the specific creditor. Whereas, by using Excel, we are able to detect the purchase order and deduct the amount straight from the aging report.

[Group Finance Assistant Manager - M18]

Figure 5.11 depicts the influence of the lack of technology affordance (technology factor) on SAP unavailability.

**Figure 5.11: The Influence of Technology Factor on ERP Usage Problems in Case B**

<table>
<thead>
<tr>
<th>Technology Factor</th>
<th>System Functionality Problem</th>
<th>Coping Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Technology Affordances</td>
<td>lead</td>
<td>System Unavailability</td>
</tr>
</tbody>
</table>

Use of Excel

Notes:

- **Affect/ leads/**: Lead to/ cause (direct relationship) – one antecedent factor leads to one problem
- **Makes**: To overcome - one problem by one coping mechanism

### 5.3.4.4 Task-related factors that contribute to ERP use problems in Case B

The findings from Case B reveal *task interdependence* as a sub-category of task-related issues. *Task interdependence* implies the degree to which individuals interact and depend upon others to accomplish their work (Campion, Medsker & Higgs 1993, p. 827). Based on this definition, in this study ‘task interdependence’ suggests that individuals interact and depend upon others to accomplish their work when using an ERP system. Lack of task interdependence
also signifies a lower degree and nature of interaction among groups required for the completion of task (Strong, Volkoff & Elmes 2001). Because SAP creates a high degree of interdependency between tasks, it requires cooperation and reciprocal relationships among groups. A Clerk from the Production Planning Control Department (C24), when commenting on task interdependence, had the following to say:

SAP is much easier compared to the manual way. However, what makes it difficult is the lack of cooperation between users. Using the SAP system requires the integration between departments, as it was not meant for individual work. If one of the two departments is not performing their work, we would face some problems later on.

[Production Planning Control Clerk - C24]

Managing task interdependency in SAP systems requires effective communication and collaboration. However, in Case B, it was found that task interdependency influences the tasks being carried out in the organisation. The task performed in Case B became too self-contained as SAP users were occupied with their own work. Consequently, lack of task interdependence meant a lower degree of exchange of input between departments or co-workers. As stated by the Finance Assistant Manager of CBSC:

From my observation, each of us was just trying to complete our own work. Some of us do it bluntly in terms of posting the data into the system....just for the sake of using it (SAP). Sometimes, we tend to disregard the consequences of our actions to others...and to make thing worse, our top management also focuses on production too.

[Finance Assistant Manager - M21]

The relationships between tasks were less emphasised by some of the SAP users in Case B. However, in using the system, each process significantly affects other subsequent processes. Thus, lack of task interdependence with the addition of lack of interdepartmental collaboration results in difficulty to accomplish the task in the needed time and leads to untimeliness issues of SAP. For example, a Purchasing Vendor Development Clerk (C26) believed that her difficulty in timely closing the month-end transactions was caused by the lack of collaboration between departments, which can be traced back to the lack of task interdependence. This occurs when users are not given cooperation in terms of posting the data into SAP in a timely manner.

It is quite difficult for me to key in the data every day without the cooperation from other departments... I think this is a major issue since it will affect the whole process in the organisation. Data need to be keyed into SAP daily but as for now, I am not able to do it.
This is because there is no cooperation between departments. 

[Purchasing Vendor Development Clerk - C26]

Another example from a Purchasing Planning and Control Clerk (C24) suggests that task interdependence affects the accuracy of SAP-generated bills for materials. In producing 50 pieces of a specific automotive part, the clerk has to utilise five parts of material/stock that are located in different storerooms. Through the Material Management Module, he needs to key the data into SAP to generate the Bill of Material (BOM). However, when other departments do not supply the data needed timely and correctly, it causes delay in generating the BOM from SAP as well as affecting the accuracy of SAP data, as reported in Table 5.15.

The effect of task interdependence factors is displayed in Figure 5.12.

**Figure 5.12: The Influence of Task Factors on ERP Usage Problem in Case B**

<table>
<thead>
<tr>
<th>TASK FACTOR</th>
<th>DATA QUALITY PROBLEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Task Interdependence</td>
<td>Untimeliness of Data</td>
</tr>
<tr>
<td></td>
<td>Inaccuracy of Data</td>
</tr>
<tr>
<td></td>
<td>Incompleteness of Data</td>
</tr>
<tr>
<td>Lack of Communication and</td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

Affect/ leads/ makes : Lead to/ cause/result in (direct relationship) – one antecedent factors lead to one problem

### 5.3.5 Coping Mechanisms

The findings from Case B identified similar scenarios as the findings from Case A, where most of the interviewees who experienced SAP problems do not seem to have any specific mechanisms to cope with them. Because SAP is a mandated system, users do not have much option but to continue using it. Thus, most end users simply ignored the problem as the way to cope. However, some SAP users of Case B adopted coping mechanisms techniques similar to
those in Case A. These include working around the SAP system by feral use of information technology and the use of feral data (part of feral use of information technology). The following sections describe each of the mechanisms employed.

5.3.5.1 Feral Use of Information Technology

The three main areas where feral use of information technology is pervasive for working around the SAP system are: (1) reporting functionalities, (2) financial tasks and (3) managing material.

First, in coping with the constraints of SAP’s reporting functions, Microsoft Excel is widely used to customise monthly financial and management reports. Usually, staff retrieves data from SAP and personalise them for better visualisation, understanding and satisfaction of the reporting needs of different managerial levels. The Assistant Manager of the Finance Department of CBSC (M21) commented, ‘As we cannot generate most of the information that we require from SAP, we have to use Excel to customise our report and also for better presentation.’

A Manager from the Finance Department of CBSC (M20) continued: ‘By using Excel, the format of management report is slightly different from SAP. We just retrieve some SAP data and transform into the Excel format. This is for presenting our report only. There is no integration between the Excel report and SAP.’ The Group Assistant Manager of the Finance Department of CBCD (M18) shared this view: ‘Currently the most updated version is Excel. To do customisation in SAP is expensive; Excel reporting is much cheaper. From Excel spreadsheet you can dice it here and there and you also can manipulate Excel the way you want it or you can have graphs from it.’ (M18).

The Group Finance Supervisor of CBCD (S19) pointed out that Excel is more usable than SAP for account management:

*The management account is better understood through Excel report. In my opinion, my boss wanted to see the detail information, which we cannot get from SAP. In SAP, we just generate the figure without additional explanation about it. Since certain required formula is not available in SAP, we need to create it through Excel file because we need to link to different sheets by using the formula.*

[Group Finance Supervisor - S19]
Apart from that, the use of Excel helps to standardise Management Reporting from all the fourteen subsidiaries. A Finance Manager of CBSC (M20) stated, ‘We are using Excel for reporting instead of SAP. This is because some of our subsidiaries have not implemented SAP system. Therefore, the Corporate Group has to create a standard template for everyone to follow or as reference to them.’ (M20)

Further, Excel is used to generate a report detailing the cost per unit of the raw material spending for one model, which is not available in SAP:

I believe the Cost Reporting Function is not available in SAP … we got the permission to use Excel for Cost per Unit [CPU] report from the head of department of Production Plant and Control. Like, for this month, we are able to know the amount produced in Excel. We called it monthly records. We really need Excel for our work. [Finance Assistant Manager - M21]

Secondly, working around SAP by the feral use of Information technology to overcome system usability and data untimeliness is also observed in the preparation of bank reconciliation, petty cash and cashbook, and generating Creditors Aging. For example, although the MIS and SAP department of CBCD does not sanction the use of Excel for bank reconciliation – ‘We have already advised them to use SAP instead of Excel but the SAP users are more comfortable to use Excel even if the function like Bank Reconciliation is already in the system’ (E16), in the Finance department of CBSC, staff have adopted this practice.

The IT department is aware on the use of Excel but they are not really given the permission. However, we have been using Excel Bank Reconciliation from the beginning… Whether they allow us to use this, of course, they already asked us to rely on SAP. They have asked us to stop using Excel. They have been talking to us about this matter so many times, but we are still in the process of transforming everything into SAP, into the system!

[Finance Manager - M20]

According to an Assistant Manager of Finance from CBSC (M21), due to the large volume of bank movements, to ensure consistency and user familiarisation, there is a need for Excel bank reconciliation.

Yes, we know that the function is there in SAP but we never ask the SAP team on how to do it from the system. … We prepare the manual bank reconciliation through Excel.
My subordinates are more familiar with it. Due to our large amount of transaction for the bank movement, we never use the function in SAP. It is not that we are against the use of SAP bank reconciliation... but for me, it is quite difficult to prepare through SAP since we are still relying on Excel Cash Book. It would not be consistent if we are using bank reconciliation from SAP while using the Cash Book from Excel.

[Finance Assistant Manager - M21]

Excel Petty Cash is another exemplar used to supplant a functionality in SAP because of the usability problem and untimeliness of Petty Cash Report from SAP. The Excel Petty Cash template was developed by a Group Finance Supervisor (S19) but not authorised by the MIS and SAP department. The use of this template duplicates work, as the data have to be uploaded into SAP for reconciling the figure in the SAP with cash-in-hand balances. Nevertheless, finance staff tends to rely on Excel for Petty Cash. This is highlighted by the following interviewees:

We are using Excel for petty cash. Currently, the most updated version is the Excel copy. Normally, we would update the petty cash in SAP only once a week and in the worst situation, we update it once a month. Yet for the Excel version [Petty Cash], they would update it daily. So, I am able to know the daily balance daily.

[Group Finance Assistant Manager - M18]

and

I try to reduce the duplication of my work. It is quite difficult since I need to prepare in Excel, then I need to verify it with SAP format and check whether it is the same or not. What I meant with the duplication is referring to the redundancy of my work. For the petty cash claim, when I receive the claim from our staff, I need to post it into Excel immediately. I do not need to compile it until the end of the month. Then, I need to check petty cash from Excel whether it matches with data recorded in the system (SAP). Excel for Petty Cash is related to the claim from the employee when it does not exceed AUD100 (RM332).

[Group Finance Supervisor - S19]

Excel Cash Book is another example of feral use of technology, which is used to cope with system usability and inaccuracy of the SAP balance carried forward for bank account and to supplant the similar function in SAP. Excel Cash Book enables the finance staff to easily and regularly track payment details such as cheque number and the recipient of a cheque. Although
the data for Excel Cash Book are derived from SAP, the format and timeliness of the information are different and the use in Excel is perceived as simpler. The Assistant Manager of Finance of CBSC said:

We are currently using the manual cash book [Excel]. While we would be able to use the same function in SAP, we are still using Excel cash book [because it is] much easier than the SAP version….We do not key in the payment detail in SAP everyday. It depends. If we are too busy, we might not key it in into SAP. The delay in keying in the SAP data causes other problems like inaccuracy of our cashbook balance. This is quite different with Excel because we will ensure that any payment made is automatically recorded in Excel.

[Finance Assistant Manager - M21]

Another example of coping with a system limitation, the rigidity of SAP layout, by use of feral information technology is found in estimating Creditors Aging. The Creditor Aging Analysis enables Case B to analyse the outstanding payments owed to their creditors (suppliers) in specified periods (such as total, 30, 60 and 90 days and more). Through the Creditor Aging reports, Case B can optimise their cash flow management and facilitate payments to their respective creditors. Although Creditor Aging should be generated through SAP, in the Purchasing Vendor Development Department, the clerk prepares her own Creditor Aging report in Excel because of the Finance Department’s requirement for detailed creditors’ movements for processing payments which cannot be handled through the standard SAP fields. This practice results in two versions of the truth.

We use Excel to monitor the supplier status. Indeed, we can use SAP for that purpose but we need to go through various reports. In Excel, I use colour code [from the Excel template] to make it easier to identify. If I am using SAP, it is quite difficult since I need to go through too many screens.

[Purchasing Vendor Development Clerk - C26]

To the best of her knowledge, the SAP function of Creditors Aging does not provide detail analysis such as: ‘What is the actual problem with the specific Purchase Order or why it is pending?’ (C26)

The Assistant Manager of Finance (M21) in CBSC reinforced the advantage of using Excel over SAP:

In my observation, the creditors listing in Excel is much more detailed compared to SAP. This happened because whenever detailed information on creditors is received, it would
be keyed in into Excel. Yet, the SAP Creditors listing is incomplete of those details. That is why I have to rely more on Excel than SAP because Excel data is extensive.

[Finance Assistant Manager - M21]

However, the Assistant Manager of Group Finance in CBCD (M18) perceived this as causing a problem: 'The work is redundant since we have two different versions: Excel and SAP Aging. I have already raised that problem to the SAP department. I need the narration to be detailed. That would make my life easy but they said that it could not be done.'

Thirdly, although the Material Management Module has been implemented, the findings indicate that Excel is widely used to bridge the problem that users experience in preparing a bill of material (BOM). This is specifically related to the BOM of any newly developed model or project. BOM is a complete list of components such as the item number of each component, the quantity required in the manufacture of a component, and the unit of measure of the item that makes up a finished manufactured product. The SAP system is supposed to generate BOM. Yet, what was discovered in the interviews is that the initial process of generating BOM is done outside the SAP environment using an Excel spreadsheet and the BOM is uploaded into SAP only upon the commencement of mass production. A Clerk from Purchasing Vendor Development Department elaborated on the listing of BOM using Excel:

We are using the manual version. What I mean is Excel before the project starts. When the mass production starts and BOM is established, we use SAP. On the other hand, Excel is used for the new project where the BOM is not finalised yet. Like for our latest model, AD60 for ALZA where the pricing system is still not ready.

[Purchasing Vendor Development Clerk - C26]

The creation of *feral data* (part of the feral use of Information technology) can also be seen in the processing of intercompany transactions, also referred to as ‘Interco’. The intercompany transaction reflects the expenses paid by the parent company (Case B), where some of the expenses belong to their subsidiaries or *vice versa*.

The Intercompany transactions are part of the subsidiaries’ expenses paid by the head quarter or other subsidiaries. For instance, if our executives travel to Korea under the expenses of another subsidiary, we definitely need to pay to the other subsidiary.

[Assistant Manager of Purchasing Vendor Development - M25]
The current installation of SAP does not support the recording and processing of Interco transactions. As a result, the monitoring of these transactions is done through feral data, that is, data stored in Excel files outside the SAP system. The Group Finance Supervisor (S19) said:

The Interco Report supplements SAP in terms of having the detail breakdown... Currently, I need to prepare the monthly report for the subsidiary; we call it as Interco Report. I prepare the report so that the subsidiary is able to take up the data. I am using Excel for this purpose due to detail information required.

[Group Finance Supervisor - S19]

### 5.3.6 Summary of Case Report B

Findings from Case B revealed eight classifications of usage problems faced by SAP users. The problems reported were: unavailability of functions, system non-learnability, system underutilisation, data untimeliness, data inaccuracy, data incompleteness, interface issues and technical infrastructure problems. Data quality was considered the most crucial problem faced by end users of Case B. The severe data inaccuracy problem is also influenced by the two other data problems reported: untimeliness and incompleteness of data. In addition to data issues, unavailability of function was also revealed to be a notable issue. In Case B, SAP users highlighted the difficulty of getting the customised reporting functionalities. Another significant problem reported is the poor interface design of SAP that deters users from using the system. The unfriendliness and complexity of the SAP system's layout is portrayed through the excessive and irrelevant fields and columns, which makes it harder for end users to appreciate and use the system. This indirectly results in underutilisation of SAP system functionalities.

The analysis of findings suggests eight major antecedent factors to the ERP usage problems. These identified factors are: inadequate training, lack of funds, lack of support, lack of control (organisational factors); lack of individual strength and lack of awareness (user-related factors); lack of affordance and lack of task interdependence (which influence lack of communication/collaboration). The last two problems represent factors from both technology and task aspects. Among the influencing factors contributing to ERP system usage problems are lack of training and lack of awareness. Lack of funds affects the ability of Case B to provide adequate training, which is reflected in the underutilisation of the system.
Finally, from the evidence of the case study, the feral use of information technology becomes the main coping mechanism employed by SAP end users. The extensive use of Microsoft Excel (feral use of information technology) occurs in various areas such as preparation of Petty Cash, Creditor Aging, Bank Reconciliation and Cash Book. The feral use of information technology (Excel) is intended to overcome problems that are mainly associated with data inaccuracy, untimeliness, unavailability of functions and system usability. Apart from that, the creation of feral data (part of the feral use of information technology) is observed in the processing of intercompany transactions, a function that is not available in SAP. Figure 5.13 depicts the relationship between the ERP usage problems and the respective antecedent factors (organisation, user and technology) and coping mechanisms employed by SAP users.
Figure 5.13: Diagram of ERP Usage Problems, Antecedent Factors and Coping Mechanisms of Case B

- **ANTECEDENT FACTOR DOMAIN**
  - Inadequate Training
  - Lack of Funds
  - Lack of Task Interdependence
  - Lack of Communication/ Collaboration
  - Lack of Control
  - Lack of Awareness
  - Lack of Individual Strength

- **END USER USAGE PROBLEM DOMAIN**
  - System Underutilisation
  - Incompleteness of Data
  - Inaccurate of Data
  - Untimeliness of Data
  - Limited Customisation
  - Poor Interface Design

- **COPING MECHANISM DOMAIN**
  - Feral Use of Information Technology
  - Feral Data

**DIAGRAM EXPLANATION**
- Arrows indicate the direction of influence. For example, "leads" indicates a causal relationship.
- "CSE" indicates a specific business factor.
- "domain" labels are used to categorize the factors and problems.

**SUMMARY**
- The diagram illustrates the interplay between antecedent factors, end user usage problems, and coping mechanisms in Case B's ERP implementation.
- Key factors include inadequate training, lack of funds, and lack of task interdependence, which lead to specific usage problems such as system underutilisation and poor interface design.
- Coping mechanisms, such as the feral use of information technology, are highlighted as strategies to address these issues.
5.4 CASE STUDY 3: CASE C

5.4.1 Background Profile of the Case

Case C is a wholly owned subsidiary of PATRON BERHAD (a pseudonym). Case C commenced commercial operations on 1 November 1999. The plant is one of the ammonia/urea plants in Malaysia. At the time of data collection, Case C had 517 employees comprising 179 executives, 332 non-executives and 6 other support employees. Case C’s organisational chart is shown in Figure 5.14.

Figure 5.14: CASE C’s ORGANISATIONAL CHART

Interviews were conducted among employees and managers from three departments involving four respondents. Table 5.18 specifies the sources of the data used in the analysis of Case C.
Table 5.18: Summary of Data Sources of Case C

<table>
<thead>
<tr>
<th>Name of Document</th>
<th>Doc’s Codes</th>
<th>Interviewees’ Job Titles</th>
<th>Interviewees’ Codes</th>
<th>Department</th>
<th>Job Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case C Annual Report 2010–2011</td>
<td>DC1</td>
<td>Executive</td>
<td>E27</td>
<td>Supply Chain Management Department</td>
<td>Responsible for the Procurement Planning</td>
</tr>
<tr>
<td>Case C General Profile 2009</td>
<td>DC2</td>
<td>Executive</td>
<td>E28</td>
<td>Finance and Planning Department</td>
<td>Responsible for the Management Accounting and company’s budget</td>
</tr>
<tr>
<td>Organisation Chart of Case C</td>
<td>DC3</td>
<td>Clerk</td>
<td>C29</td>
<td>Finance and Planning Department</td>
<td>Preparation of General Ledger, A/payable, A/receivable, Assets and Projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Executive</td>
<td>E30</td>
<td>Human Resource Management Administration Department</td>
<td>Responsible for the Shared Services and Employee Recruitment and Relations section of HRMA</td>
</tr>
</tbody>
</table>

5.4.2 IT Department and ERP (SAP) system in Case C

Case C used to have its own internal IT Department to manage all the information systems and any IT-related issues. In 2000, Case C replaced the services of the internal IT Department with a third party vendor called iPerintis. iPerintis manages Case C’s IT infrastructure and provides support for all the information systems deployed in Case C. Apart from iPerintis, Case C also has a functional relationship with the Corporate Information Development Unit (CIDU), which oversees all IT matters. In addition, an IT Unit has been set up within the Finance and Planning Department of Case C as a focal point of reference for coordinating IT matters with CIDU and iPerintis.

The ERP system that is currently used in Case C is SAP (Systems Application and Products in Data Processing). At the time of data collection, Case C was using SAP R/3 version 6.2 and was in the process of upgrading to SAP ECC6. Five core SAP modules are used in Case C: Material Management Module (MMM), Financial Information and Cost Controlling (FICO), Human Resource Integrated Systems (HRIS), Plant and Maintenance Module (PM), and Sales and Distribution (SD). Table 5.19 outlines the company’s snapshot.
### Table 5.19: Summary Profile of Case C

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Background</strong></td>
<td></td>
</tr>
<tr>
<td>Industry Sector</td>
<td>Industrial Gases</td>
</tr>
<tr>
<td>Business Segments</td>
<td>Petrochemical</td>
</tr>
<tr>
<td>Incorporation</td>
<td>1 November 1999</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>517 (as of 2010)</td>
</tr>
<tr>
<td>Core Products</td>
<td>Granular Urea</td>
</tr>
<tr>
<td>Additional Products</td>
<td>Ammonia and Methanol</td>
</tr>
<tr>
<td><strong>IT and ERP</strong></td>
<td></td>
</tr>
<tr>
<td>Number of employees in the IT department</td>
<td>None (the IT department was outsourced to a third party vendor iPerintis)</td>
</tr>
<tr>
<td>Type of ERP System</td>
<td>SAP R/3</td>
</tr>
<tr>
<td>Implementation (Go Live) Date</td>
<td>November 1999</td>
</tr>
</tbody>
</table>
| Modules Implemented | - Financial Information and Cost Controlling (FI and CO) Modules  
- Material Management Module (Triple M)  
- Plant and Maintenance Module (PM)  
- Human Resource Integrated Systems Module (HRIS)  
- Sales and Distribution Module (SD) |
| Upgrade History | Introduction of SAP at Case C in November 1999  
The upgrading to SAP ECC6 (expected to be completed in 2012) |
| Motivating Factors for Adopting SAP System | - To cope with the complexity of the job  
- Providing a proper and secured database for business data  
- Having seamless integration of data from all departments |
| Reasons for System (SAP) Upgrade to ECC6 | Problems associated with poor analysis features in SAP R/3  
Time-consuming in generating reports  
Slow in terms of response time  
To take advantage of new technologies and business strategies by adding functionality  
Provide new, expanded or improved features |
| Current Situation of ERP Use | SAP mainly used for operational tasks  
The percentage between 65% to 80% of implemented system capacity exploited  
Underutilisation of the implemented modules  
Cost hindering expansion to other modules |
| Major Benefits | Proper recording of data  
Easy retrieval of data for further analysis  
Ease in monitoring the equipment history  
Expedite the job/process – interpreting data, speed up work, data storage  
Managing day-to-day work  
Standardisation and centralising of maintenance processes |

*Source: Compiled from Annual Report of 2010 and Interview Sources of Case C*
5.4.3 Problems and Issues in SAP (ERP) System Use

The analysis of the interviews has identified system functionality (unavailability), non-understandability (usability), underutilisation, data quality (inaccuracy), and interface problems.

5.4.3.1 System problems

In terms of **unavailability of functions**, all of the SAP users interviewed believed that the required monthly financial, human resource and supply chain reports could not be produced from the system. The respondents believed that the ERP system has a rigid format concerning how the information can be organised; and the SAP report generated via the Business Warehouse function is user-unfriendly and quite difficult to understand. As a result, users often need to pull out the data from the system manually and then generate a report by using Excel. The unavailability of a customised reporting format also means that SAP users from Case C are not fully utilising the existing Business Warehouse reporting functionality. Moreover, the interviewees indicated that there is no SAP function for producing year-end projection figures for sales, which is an essential requirement for budget preparation. This is because SAP was not customised to calculate the value projected (VP) of the production. As the figure is critical for the budget, users have to utilise Microsoft Excel to cope with the unavailability of that function.

Besides the lack of some functionality, although users have a basic understanding of the relevant business process and despite their initial training, they usually find the SAP representation of those business processes difficult to understand. As a result, they are unable to appreciate the system (SAP) and use it to its full potential.

Further, the SAP users from Case C **underutilise** the system. For example, the Supply Chain Management and Human Resource Management and Administration departments’ interviewees claimed that they had little exposure to the system and have developed a fear to explore and fully utilise the system further. Table 5.20 summarises system-related problems reported by interviewees.
### Table 5.20: Examples of System Related Problems in Case C

<table>
<thead>
<tr>
<th>Where</th>
<th>What</th>
<th>Interview Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance and Planning Department</td>
<td>The limitation of SAP system to provide customised finance report forced users to rely on Excel.</td>
<td>The customised finance report is not available in SAP. What we had from the system is a generic report with too much information. We had to further simplify it, for a better understanding. So, we would download data from SAP and transform it into the Excel format. [Finance and Planning Clerk - C29]</td>
</tr>
<tr>
<td>Human Resource Management and Administration Department</td>
<td>Users use Excel in presenting reports as the SAP report format is unable to meet their needs</td>
<td>We need Excel for our job. We cannot possibly be without it. Excel is used for report presentations. The customised report is not available in SAP. Although the data is derived from SAP, it cannot be amended in any way. Once we transfer the data to Excel, then it can be modified. [Human Resource Management and Administration Executive - E30]</td>
</tr>
<tr>
<td>Supply Chain Management Department</td>
<td>Unavailability of SAP function to generate customised reports</td>
<td>The SAP report does not give you the information that you require. It just makes your work more difficult. The report is not easy to use. So, we have to convert it to another format. [Supply Chain Management Executive - E27]</td>
</tr>
<tr>
<td>Finance and Planning Department</td>
<td>The end-year projection of sales is not directly available in SAP</td>
<td>There is some information or data in finance that SAP cannot cater for. For example, SAP is unable to extract end year projection figures, such as for the quantity or sales volume for budgeting purposes. [Finance and Planning Executive - E28]</td>
</tr>
<tr>
<td>Supply Chain Management Department</td>
<td>The unavailability of the customised SAP contract document for monitoring the contract detail</td>
<td>When we create the Purchase Requisition through the system, SAP was unable to automatically deduct the contract balance of the vendor. This is because the required information is not customised in SAP. There is not enough space to enter detailed information, such as bond, insurance user and contract expiry date. [Supply Chain Management Executive - E27]</td>
</tr>
<tr>
<td>Finance and Planning Department</td>
<td>The non-understandability issue faced by SAP users with regard to the cost calculation in SAP</td>
<td>I still could not see how costs are being posted from one department to another in the SAP system cost. If you fiddle with something, you are messing with something that other OPU’s plants are using too, and you just cannot do that. This is because each of the PATRON’s plants is the same, so you do not know whether you will mess up somewhere else. [Finance and Planning Department Executive - E28]</td>
</tr>
<tr>
<td>Human Resource Management and Administration Department</td>
<td>The non-understandability problem of SAP users limits their use of the system within their confined scope</td>
<td>I do not know how to use most of the HRIS functions. I do not know if the information is relevant to me or not. [Human Resource Management and Administration Executive- E30]</td>
</tr>
</tbody>
</table>
5.4.3.2 Data quality problems

The data quality issue highlighted in Case C pertains to the *inaccuracy* of SAP data. In the Finance and Planning Department, one of the interviewees reported usually encountering discrepancies between the recorded purchase order in SAP and the actual inventory received. This was due to the time lag in updating the inventory data into SAP.

We did have problems related to closing the open item in SAP. For example, when we raised the Purchase Order (PO) and received the goods, the recorded amount in PO (SAP) and the actual quantity of goods were different.

[Finance and Planning Executive - E28]

The inaccuracy of inventory data as reported also affects subsequent processes such as failure to set off the open item for month-end closing. As a result, users are unable to balance monthly accounts and close purchase orders. In another instance, one of the interviewee described a data quality problem associated with incorrect salary input.

We have some problems in using SAP. For example, if we mistakenly key in the inaccurate figure [of salary], it would be auto generated by the system. Consequently, our staff would receive the incorrect pay.

[Human Resource Management and Administration Executive - E30]

In order to overcome this, the Finance and Planning executive (E28) was required to perform a thorough check to avoid similar mistakes occurring. Currently, to minimise the potential error of data entry, a lock button has been incorporated in the latest SAP version. The inaccuracy of data is due to the wrong posting of data by end users who lack either SAP knowledge or accounting knowledge or both. According to the Finance and Planning Clerk
Both SAP and accounting knowledge has to be well understood in order to avoid any incorrect data entry that has occurred previously.

## 5.4.3.3 Interface problems

The interface problems reported in Case C are: (1) the unattractiveness of the SAP screen design and (2) uncustomised screen design. Relating to unattractiveness, the monotonous and dreary layout of the SAP screen has been compared to other online applications. Without a colourful and interactive screen, SAP is considered less appealing, especially for novice users. An executive from the Supply Chain Management Department (E27) highlighted the deficiencies of the SAP system screen layout compared with other online applications:

> One limitation of the SAP is that it is very boring to look at. Right now, you have web based that are so interesting and colourful. As for SAP, you only have one tone. If you choose pink, all will be pink. That is why our staffs have said that SAP is boring to use, especially in processing the day-to-day transactions or even in generating the reports.

[Supply Chain Management Executive - E27]

As a result, younger users are not attracted to learn the full aspects of the system voluntarily (apart from their own job scope). An executive from Human Resource Management and Administration (E30) who had years of experience in recruiting new employees had the following to say: ‘In terms of interface, there is no problem if the person is skilful but for a novice user, they might have difficulties in using SAP. The boring layout of the SAP screen is unable to attract our new beginners to explore the system further.’

Figure 5.15 shows the relationships between these problems. Following that, the analysis of the findings of the antecedent factors that lead to the problems is described.
Figure 5.15: Diagram Showing the Relationships between ERP Usage Problems in Case C

Notes:

- **Affect/ leads/makes**: Lead to/ cause (direct relationship) – one problem lead to the other problem
- **Influences**: Indirectly affect – one problem mediate the other problem
- **Cope by**: To overcome - one problem overcome by one coping mechanism

### 5.4.4 Antecedents of ERP usage problems

Similar to the previous two cases, the analysis of the interviews revealed organisational, user and technological factors that cause the problems reported in the previous section.

#### 5.4.4.1 Organisational Factors that contribute to ERP use problems in Case C

One antecedent factor that affects system non-understandability is the **lack of support to end users**. Although iPerintis is expected to provide the IT support to Case C, it is not able to render the support required by users. The limited technical expertise was highlighted by an executive of the Finance and Planning Department (E28), who said:

> As our external consultant, iPerintis could not provide their expertise in terms of SAP. Most of our staffs need to learn through their own experience or by asking their colleagues. I think this is not fair since we are paying a lot for iPerintis services. Sometimes, we got to the point where we just try to solve things on our own, by trial and error, which I think is dangerous for this type of system.

[Finance and Planning Executive - E28]
An executive from the Supply Chain Management Department (E27) also pointed out the lack of technical support from iPerintis. She said:

What happens in PATRON was that in the year 2000, we outsourced our IT Department to iPerintis. They became the service provider for IT. This includes taking care of the IT infrastructure, maintaining the internal Information system, maintaining the server and some other related functions. However, with respect to SAP, iPerintis have not yet played a major role. iPerintis have been unable to assist our staff effectively in terms of providing the necessary support services since most of their staff [iPerintis] are also not conversant with the system.

[Supply Chain Management Executive - E27]

Lack of technical expertise and support has not been overcome by the establishment of the internal IT Unit in the Finance and Planning Department in Case C. This unit is responsible in coordinating internal IT activities. According to an executive who had years of experience in this department (E28), the reason to set up this internal IT unit was that ‘this unit is the focal unit between iPerintis and [Case C]. For instance, if we wanted to get information on the product costing module that has been rolled out in other OPU’s, the IT unit will contact iPerintis.’ However, the focus of the internal IT unit is more on providing technical support to the existing in-house developed systems. A comment made by the executive from the Finance and Planning Department (E28):

We have set up a specific unit in handling IT matters internally in this department. However, what I could say is that they are not knowledgeable in SAP. They spend so much time in trying to understand the system itself rather than assisting with the problem we encountered in using SAP.

[Finance and Planning Executive - E28]

An executive from the SCM department (E27) reinforced the inadequate experience and skills of the internal IT unit.

Actually, there is one person dedicated to conduct the training, to monitor the percentage and for plant maintenance…but I guess because she is pretty new, whereas the previous person managed to, how do you say, to bring SAP to another level with the new system that he created. As for the new consultant, she needs to learn a lot since she is not familiar with the system. That is why she was unable to attract people to attend the training!

[Supply Chain Management Executive - E27]
The lack of support influences the user’s lack of individual strength and their understanding of SAP. For example, an executive from the Human Resource Management and Administration department (E30) pointed out:

I do not know how to use most of the HRIS functions. I do not know if the information is relevant to me or not. To get assistance from iPerintis or our IT unit is another issue. It will take a long time to resolve the problem that I have raised; I need to ask them repeatedly. Sometimes I feel so frustrated with them. They do not help me much in understanding the system better.

[Human Resource Management and Administration Executive - E30]

The lack of support also contributes to the data inaccuracy issue. An instance to illustrate this relationship was described by an executive from the Finance and Planning Department, as highlighted in Section 5.4.3.2. According to her, the inaccuracy of data can be traced back to the lack of SAP knowledge (individual strength) that is influenced by the insufficient technical support received from the support team.

The above discussion shows how the level of support received from external and internal expertise affects a SAP user’s individual strength and can often result in SAP non-understandability and data inaccuracy issues. This relationship is further illustrated by Figure 5.16.

**Figure 5.16: The Influence of Organisational Factors on ERP Usage Problems in Case C**

![Diagram showing the influence of organisational factors on ERP usage problems](image)

**Notes:**
- **Affect/leads/makes**: Lead to/cause (direct relationship) – one problem antecedent factor lead to the other problem
- **Influences/Contributes**: Indirectly affect – one problem mediate the other problem
5.4.4.2 User-related factors that contribute to ERP usage problems

Within the user dimension, the initial framework identified two sub-categories: magnitude and individual strength. However, in Case C, individual strength and attitude were found to affect SAP usage. Users’ lack of individual strength contributed to their lack of understanding of SAP. To cite one of the participants:

If the person is skilful, they would not have much problem with SAP. From my own observation, the inexperienced users had some difficulty to use the system. The new users will need a longer time to gain their self-confidence. No doubt, guidance from their peers and mentors are sought after... eventually, they will be more confident. [Human Resource Management and Administration Executive - E30]

He added that users’ lack of individual strength has significantly influenced the confidence level of novice users, in turn leading to underutilisation of SAP.

For the beginners, usually they are afraid to explore the system further. They do not fully utilise some of the HRIS functions. That is why we get help from our colleagues before we proceed. We become more confident when we are used to it. [E30]

SAP users who possess inadequate general computer skills might feel incompetent with the SAP system. This aggravates the non-understandability problem and, in a worst case scenario, it adds to the data inaccuracy problem. A remark by an executive of Finance and Planning (E28) captured this:

We lack knowledge of the system. I feel so frustrated because sometimes we need to make an adjustment to our transactions or else it will impact the accuracy of the SAP data. I believe the problem that we encountered is because of user’s lack of self-confidence with the system; they do not have adequate general computer knowledge. [Finance and Planning Executive - E28]

To demonstrate how the lack of individual strength affects data accuracy, an executive from the Supply Chain Management Department (E27) gave an example:

Normally there are too many details that need to be entered into the system when we want to purchase the material. Some of our SAP users are still not familiar with how to raise Purchase Requisitions correctly. This would trigger a problem in using SAP because they are likely to make mistakes in the data entry process, such as keying in the wrong material code. The user’s lack of knowledge of the business process is probably the reason behind this issue. [Supply Chain Management Executive - E27]
In addition, the four participants in Case C shared examples of a **negative perception** concerning SAP. For instance, an executive from the Supply Chain Management department (E27) commented:

> People just keep on calling SAP by a certain nickname because of its hassle. They do not call it as SAP but the other way around like 'susah' something / [difficult something]... because they hate it. For them, the system is too complex... that is always in their mind, so they could not care less about the system. We could see this from their attitudes.

> [Supply Chain Management Executive - E27]

Other respondents hold similar opinions. According to one executive, the poor interface design has affected his interest to learn about the system. This is shown through his negative attitude to SAP that leads to usability issues.

> Actually, I do not really like the SAP system because the interface is too boring. I do not want to learn about this system. However, I think the screen layout can be improved, but sometimes, SAP is so confusing, especially for a new user. I admit that my attitude has affected my ability to learn and understand the system.

> [Human Resource Management and Administration Executive - E30]

In another incident, an executive from the Finance and Planning Department who had years of working experience expressed his concern about the negative feelings towards the SAP system by some of his colleagues. He said:

> I know that we do not have any other choice but to use the system [SAP]. From day one, it has been introduced to this department. Yet from what I noticed, there are some staffs that are not full hearted in using the system [SAP]. For them, SAP is far too complex since they believe SAP has change the way they are doing things. They are no longer in their comfort zone. As such, it was portrayed through their attitude towards the system.

> [Finance and Planning Executive - E28]

From the findings, a negative attitude to SAP is influenced by a user's age and their previous IT experience. One of the participants suggested that each user would favour different ways of learning. Illustrating this statement, an executive from the Supply Chain Management Department (E27) said:

> I think if you’re IT savvy, it is a bonus because you tend to be more interested in exploring the system. Usually for the senior users, they are quite slow but the younger
generation, they like to explore. You know that some people love gadgets and IT and some just could not be bothered. This is also applicable to SAP.

[Supply Chain Management Executive - E27]

To sum up the discussion on the user factor, Figure 5.17 captures the relationships between user-related factors and ERP system usage problems.

**Figure 5.17: The Influence of User Factors on ERP Usage Problems in Case C**

![Diagram showing the influence of user factors on ERP usage problems in Case C]

**Notes:**

- **Affect/ leads/makes**: Lead to/ cause (direct relationship) – one problem antecedent factor lead to the other problem
- **Influences/Contributes**: Indirectly affect – one problem mediate the other problem

**5.4.4.3 Technology-related factors that contribute to ERP usage problems in Case C**

The technology-related factor found in Case C is lack of technology affordance. For example, the absence of a direct link between the Financial Information and Cost Controlling (FICO) and Plant and Maintenance (PM) modules in SAP resulted in users' inability to track down the maintenance cost to the specific General Ledger account. This creates difficulty when processing the purchase request as the Supply Chain Management staff are unable to keep
track of the allocated budget assigned to them. An executive from the Supply Chain Management Department (E27) remarked:

The plant maintenance module faces the problem when we want to create a Purchase Requisition; it is unable to track the ‘home budget’. Say for example the specific cost for the General Ledger account. This is because; at present, the Finance Information and Cost Controlling (FICO) and Plant Maintenance are two separate modules. [Supply Chain Management Executive - E27]

To solve this problem, one staff member in Case C took an initiative to create an interface that is able to link these modules. The program created is known as Integrated Maintenance and Planning Support (IMPS). This interface was created outside the SAP environment by using Lotus. Through IMPS, SAP users that are using Plant and Maintenance are able to trace the relevant account and cost involved from FI and CO modules. An executive from the SCM Department (E27) added: ‘The staff created the interface to link the two modules. With this link, it helps us to identify the related General Ledger account used and the assigned cost once we create the purchase requisition.’

Lack of SAP technology affordance is also exhibited in generating contract documents. In this situation, the additional information required for the contract is lacking since the design of the SAP screen does not permit SAP users to enter detailed information such as insurance. An executive of Supply Chain Management stated:

Since SAP could not be customised according to our needs, we have to do it outside the ERP system. In this case, we are unable to put in the insurance details as there is no available field allocated. [Supply Chain Management Executive - E27]

This creates another dilemma because: ‘we are unable to have detailed information in which we could monitor. We are having difficulty in monitoring the bond, insurance and other important information with respect to the contract’. [Supply Chain Management Executive - E27]

Apart from the above examples, SAP offers limited functions to generate customised reports due to lack of technology affordance. SAP users shift to Microsoft Excel to simplify the reports produced by SAP.

If the report is meant for users in the Finance Department, usually we do not have any problems to generate it from SAP. However, if the report is meant for outside circulation, we usually download from SAP and transfer it into Excel format. This is to
further simplify it and for easier understanding. Usually, other users found that the report generated from SAP is quite complicated. Besides, our SAP report is also quite confidential and cannot be easily accessed by anyone.

[Finance and Planning Clerk - C29]

Figure 5.18: The Influence of Technology Factor on ERP Usage Problems in Case C

Notes:

Affect/ leads/makes : Lead to/ cause (direct relationship) – one problem antecedent factor lead to the other problem

Cope by : To overcome - one problem overcome by one coping mechanism

Figure 5.18 depicts the relationship between the lack of technology affordance and ERP system problems in Case C.

5.4.5 Coping Mechanisms

One of the strategies employed by end users to cope with the ERP system use usage problem in Case C was to disregard or ignore the problem and continues to use the system. The detailed description of this strategy is highlighted in Section 2.4. This step is seen as necessary since SAP system is a mandatory information system used in Case C. For instance, the following statement showed how one of the employees in the Finance and Planning department deals with system configuration issues by ignoring the problems.

We would try to troubleshoot the problem first. If we are stuck with it and if the problem is related to system configuration, we would raise a service request to iPerintis. But if iPerintis takes a longer time to resolve the issue, we still need to use the system, so we just have to bear with it and try to find our way out.

[Finance and Planning Executive - E28]
Other users also employ the mechanism of feral use of information technology to overcome the ERP system usage issues and create feral data by the feral use of Information technology. In Case C, SAP users also bypass the SAP system to deal with ERP usage issues.

5.4.5.1 Feral Use of Information Technology

To deal with the unavailability and interface shortcomings of the SAP system, Finance and Planning and Human Resource and Administration users work around the SAP system through feral use of information technology. This type of coping mechanism is mainly found in the area of report generation and analysis. In the words of one participant:

In the Finance and Planning Department, some of the reports generated by SAP such as Asset List account, is complex and has confidentiality issues as all of the content shouldn’t be revealed to all users. Therefore, we downloaded the report from SAP, transfer the data to Excel and simplify it by transferring to Excel.

[Finance and Planning Clerk - C29]

In the above quote, it can also be noted that the use of Microsoft Excel for Asset List account is intended to overcome issues related to the non-understandability problem. Since it is quite difficult to use the SAP reporting format, Excel is viewed as the best option in resolving this matter. An executive from the same department (E28) had the same opinion. In another situation, based on the comment made by an executive of HRMA, Excel reports are considered as very useful and preferable to the SAP reports because users are able to make some modifications that are difficult through SAP. According to the executive:

Although we are using SAP, it is not intended for reporting purposes. We still need to use Excel to perform our job. We cannot possibly be without this spreadsheet. Excel is used especially to customise the presentation of our reports. Even though the report data is derived from SAP, yet the limitation of the SAP report is that it cannot be amended in any way. We were only able to modify and customise the report once we transferred it into the Excel format…. Our SAP users prefer to use the Excel version since it can easily be customised to suit their needs.

[Executive Human Resource Management and Administration - E30]

Feral data as part of the feral use of information technology to work around the SAP system was also utilised to overcome SAP usage problems such as the unavailability of functions for the budget consolidation. The Budget Consolidation Template was created as a data capture
and accumulation mechanism and is used to capture budget data from various departments of Case C. According to an executive from the Finance and Planning department (E28):

We have about 12 departments in B. So, during the budget cycle process, there are certain online templates which need to be keyed in by the budget focal person. I developed this template myself. [Finance and Planning Executive - E28]

Because an individual developed this template, it is not maintained by IPerintis nor is it sanctioned by CIDU or the SAP Business Support Unit. The sanctioned system for budget consolidation in Case C is a system called Budget Planning System (BPS) that is integrated with SAP. However, the consolidation function of the budget data is only made available via BPS used by the holding company. This was explained in a statement by the same executive (E28): ‘For the holding company, they have budgeting function that can consolidate all the budget data from various departments; however such function was not extended into our OPUs yet. Due to some limitation of current BPS system, we use our own template for such purpose.’

The Budget Consolidation Template is not a comprehensive or complete system. It concerns how budget data is stored and prepared outside the SAP environment.

The one that I use here [Budget Consolidation Template] is only for my OPU. I developed the Budget Consolidation Template myself. The template is how I captured my own budget data. Based on the Budget Consolidation Template, we uploaded into the SAP Budget function for further budgeting process. [Finance and Planning Executive - E28]

Besides the Budget Consolidation Template, another example of this type of coping mechanism is the creation of Purchase Requisition. As explained in the system-related problem findings (refer to Table 5.21), the SAP purchase requisition function is not able to automatically deduct the contract balance. Hence, purchase requisition is created outside the SAP system environment. The comment made by an executive from the Supply Chain Management department (E27) was:

Purchase Requisition cannot be customised in SAP. This is because of the unavailability of the sufficient column in recording the detail information such as insurance and bond. Thus, we were unable to monitor the bond and insurance used through the system. Therefore, the creation of purchase requisition needs to be carried out outside the SAP environment. [Supply Chain Management Executive - E27]
5.4.5.2 Bypassing SAP

Another way users cope with the SAP interface problems is by avoiding some steps required in the system (SAP). This is seen as a necessity since users believe that the SAP system's interface is not user friendly and is complex. An executive from the Supply Chain Management Department (E27) illustrates how she bypasses the SAP steps while processing taxation:

In processing our taxation figures, we have to bypass some of the steps required by SAP. When you manipulate the data, you must know what you want and how to do it. When we bypass the steps, we omit the less important field that has no added value to our report. For instance, the taxation figures field will usually not be captured by the system once we run the report, although detailed information was required by our customer. So in this case, you just mark ‘xx’ to the column field that you consider as least important. That's about it. It will be a waste of time if you try to figure it out. [Supply Chain Management Executive - E27]

Another example of how users bypass some of the SAP system routines for the Material Management module is seen in the following statement made by one of the executives:

The source lists of vendors have been blocked in the system [SAP] to restrain users from using unregistered vendors. Supposedly, no one will be able to modify or amend the source list so that they can only purchase the material from the registered suppliers [in the list]. Nevertheless, it does not work. By using a back door, they are still able to create a new source list and purchase from other suppliers. [Finance and Planning Executive - E28]

5.4.6 Summary of Case Report C

The results from Case C identified three categories of problems: system, data quality and interface problems. Similar to Case A, system-related problems (unavailability, non-understandability, underutilisation) were revealed to affect ERP users most. Data inaccuracy problems were also another area of concern for SAP users of Case C. Similar to the other two cases, organisational and user factors were identified as the two major contributing factors to ERP problems. Lack of technical support (organisational category) received from both internal IT support and the external IT consultant (iPerintis) affected users' individual strength and resulted in system understandability issues. These antecedent factors also
contributed to the accuracy of data entered into the system, especially for the Material Management module.

Post-ERP usage problems and linked causal factors have led to end users developing coping mechanisms of feral use of information technology which also indirectly creates feral data. The coping mechanisms are employed to overcome the unavailability of functions and system non-understandability problems. Another way to cope with ERP problems such as poor SAP screen design is through bypassing and ignoring. Figure 5.19 shows the overall relationships between the SAP usage problems, the respective antecedent factors (organisation, user, and technology) and the coping mechanisms employed.

5.5 SUMMARY OF THE CHAPTER

The experiences of users from three multinational companies in Malaysia, namely, Cases A, B and C, were methodically examined to investigate the research questions. Analyses and interpretations were constructed and verified on the basis of the interviews in order to develop an in-depth insight into the phenomena. In the context of this thesis, this refers to users of the ERP (SAP) system. Using an iterative process, each case was examined during the within-case analysis, as reported in Chapter 5. The qualitative method enables a researcher to capture individuals' points of view concerning their experiences in using the ERP system in the context of the three main research questions posed earlier. The three case studies reported on four common areas of ERP system use problems: system, data, technical and interface problems. In addition, four major categories of antecedent factors reported from the case studies were: organisation, user, task and technology. In dealing with the ERP usage issues, the four major classification of coping mechanisms reported from the three cases were: feral information system, feral use of information technology (inclusive of feral data) and bypass the problem. The relationships between the usage problems, antecedent factors and coping mechanisms are further discussed in Chapter 6, which also presents the EUPCOM Development Model and the research propositions formulated from the case studies discussion.
Figure 5.19: Diagram of ERP Usage Problems, Antecedent Factors and Coping Mechanisms in Case C
Chapter

6

Discussion: A Model of ERP Use Problems, Antecedents and Coping Mechanisms

6.1 INTRODUCTION

This chapter compares the results from the case studies and discusses the findings in the context of previous literature. In discussing the case studies presented in Chapter 5, this chapter is structured in four sections. The chapter starts with the cross-case analysis highlighting the similarities and differences between the three cases (6.2). Next, a model of ERP usage problems, antecedents and coping mechanisms called the EUPCOM (End User Usage Problems and Coping Mechanisms) Model is presented (6.3). By proposing the revised model, this study appears to have a pioneering role in integrating the post-implementation ERP issues, the antecedent factors to ERP usage problems, and the use of feral system conceptualisation in coping with the identified ERP issues. The discussion of the EUPCOM Model leads to a number of research propositions to illustrate the complex relationships between the three domains of the research. A summary of the chapter is presented to conclude the chapter (6.4).

6.2 CROSS-CASE ANALYSIS

Analysis of the three case studies has revealed that SAP (ERP) usage issues faced by end users fall within four main areas: **system, data, technical and interface problems**. System-related problems cover complexity, unavailability, non-interoperability, non-understandability, non-learnability and underutilisation of SAP. Data quality problems cover untimeliness, inaccuracy and incompleteness of SAP data. Technical issues refer to inadequate technical infrastructure. Interface problems cover the poor quality of the SAP input-output screens.
These problems are interrelated. For instance, the system complexity (functionality problem) of the SAP system aggravates the difficulty in learning the system (usability issue) and leads to the system underutilisation issue. System non-learnability contributes to data untimeliness and incompleteness, while these two data problems render the SAP data inaccurate. The poor interface affects system learnability. The complex relationships between the SAP usage problems are further discussed later in this chapter in arriving at the proposed model.

The antecedent factors domain refers to the factors that contribute to ERP usage problems. The literature review suggested that the causal factors comprised four main categories: organisation, user, task and technology. These causal factors have a complex relationship among themselves and with end users’ problems. To cope with ERP usage problems, users have employed three main coping mechanisms: feral information systems, feral use of information technology and feral data.

In order to facilitate a deeper understanding of the cases and accentuate the differences between them, it is important to consolidate the findings of the within-case analyses with a cross-case analysis. A principle aim of this cross-case analysis is to derive conclusions which go beyond the separate and individual impressions of each case. Key findings across cases are discussed within the conceptual model context. The cross-case analysis is intended to identify important similarities and differences and to explore possible bases for these patterns in different cases.

Three tactics are proposed by Eisenhardt (1989) in conducting a cross-case analysis. First, select categories or dimensions and then look for within-group similarities coupled with inter-group differences. The second tactic is to select pairs of cases and list the similarities between each pair, and the third tactic is to divide the data by data source (Eisenhardt 1989, pp. 540-1). To illustrate specific and common characteristics of the ERP problems, the antecedents of the problems and coping mechanisms in the scope of a cross-case analysis, the three cases are contrasted in Table 6.1. To construct the table, this study employed the first tactic proposed by Eisenhardt (1989). Through this technique, the subtle similarities and differences between three cases were identified and compared. The point of departure for the cross-case comparison is based on the three sub-research questions as set out in Section 1.3.
### Table 6.1: Cross-Case Analysis: ERP Use Problems

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SYSTEM FUNCTIONALITY</strong></td>
<td>Unavailability of Functions</td>
<td>SAP lacks some functionality for the analysis and reporting of maintenance jobs and emailing notification</td>
<td>The unavailability issues of SAP mainly pertain to the lack of customised reporting functionalities</td>
<td>The unavailability issues of SAP mainly pertain to the lack of customised reporting functionalities</td>
</tr>
<tr>
<td></td>
<td>System Complexity</td>
<td>SAP is a complex system to be fully explored when implemented in an organisation without or with limited IT experience</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>System Non-Interoperability</td>
<td>The interoperability problem experienced by SAP users in Case A is due to the absence of a link between SAP system and either commercial software or in-house applications</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>SYSTEM UTILISATION</strong></td>
<td>System Underutilisation</td>
<td>The size of the company has led to some SAP system functionalities being under-exploited</td>
<td>Underutilisation problem occurs when SAP users are not exploiting SAP system functionalities</td>
<td>Underutilisation of an advanced SAP functionality for improvement of work</td>
</tr>
<tr>
<td></td>
<td>System Non-Learnability</td>
<td>The difficulty of end users to learn the SAP system triggered the need to frequently cite the learning material tools</td>
<td>SAP users do not learn to use the system quickly as they feel they need to learn a lot of things before they can get going with SAP</td>
<td>X</td>
</tr>
<tr>
<td><strong>SYSTEM USABILITY</strong></td>
<td>System Non-Understandability</td>
<td>X</td>
<td>X</td>
<td>SAP users facing difficulty to understand the system and limit their ability to further use the system</td>
</tr>
</tbody>
</table>


**Chapter 6: Discussion**

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA QUALITY</td>
<td>Inaccuracy</td>
<td>Inaccuracy of data affected the analysis of the equipment fault in case A (in the areas of the calculation of mean time between failures and establishing the cause code of the equipment failures)</td>
<td>The data inaccuracy problem reported in Material Management that led to inaccurate input for the subsequent processes (in the areas of managing Bill of Material (BOM) for backflush process, processing the payment for the vendor and planning of production)</td>
<td>The inaccuracy of SAP data due to wrong posting of SAP data by end users leads to limited data storage space in SAP (in the areas of recording Purchase Order and inventory data)</td>
</tr>
<tr>
<td></td>
<td>Untimeliness</td>
<td>X</td>
<td>The untimeliness problem in relation with data that was not keyed in on a daily basis or during the required time resulted in setback in generating the updated stock information (in areas such as during the receiving process and recording the bill of material for the new project)</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Incompleteness</td>
<td>X</td>
<td>The omission, missing and exclusion of some of the required data in SAP (in the area of inputting the taxation figure and ‘free of charge items’ for the backflush process)</td>
<td>X</td>
</tr>
<tr>
<td>TECHNICAL INFRASTRUCTURE</td>
<td>Poor Technical Infrastructure</td>
<td>X</td>
<td>The slow server and network issues that slowed down the business process</td>
<td>X</td>
</tr>
<tr>
<td>INTERFACE</td>
<td>Poor Interface Design</td>
<td>The interface problem associated with poor SAP screen design, unfriendly interface, an old fashioned screen layout that failed to offer an interactive pop-up menu and the textual interface that is not favoured by the new generation of SAP users</td>
<td>The poor SAP screen design with excessive and extraneous layout as well as unfriendly user interface</td>
<td>The interface issue associated with the unattractiveness of SAP screen design and uncustomised screen design</td>
</tr>
</tbody>
</table>

**Common Problems = Problems found in at least two cases**
In Table 6.1, the cross-case analysis reveals that the common problems raised by SAP users are related to: (a) system functionality (unavailability of functions), (b) system usability (non-learnability), (c) underutilisation, (d) data inaccuracy and (e) unfriendly interface.

For the antecedents factor, a total of 10 themes have been identified within the respective categories (see Table 6.2 for detailed summary). The respondents from the three cases suggested a range of causal factors such as lack of training, lack of expertise, lack of individual strength, user negative attitude, lack of awareness and lack of affordance. It is interesting to note that three dominant antecedent factors lead to SAP usage issues in all the cases. These factors of a particular interest are: (i) lack of technical support (organisation-related factor), (ii) lack of individual strength (user-related factor) and (iii) lack of technology affordance (technology-related factor).

The cross-case analysis shows that lack of technical support from the organisation dimension has affected SAP usage in all three cases. While Cases A and C were unable to gain adequate technical support from the external consultants due to lack of SAP expertise and knowledge, Case B faced problems with the insufficient number and mobility issues of their internal experts. However, insufficient technical support in all cases resulted in lack of individual strength that caused inaccurate data being entered into the system.

The other notable cause of problems with SAP use found in the three cases is technology affordance. Due to this factor users faced problems related to the unavailability of functions, specifically customised SAP reporting functionalities (see Table 6.1 for detailed analysis). The distinctive antecedent factors from the cross-case comparison are inadequate training (organisational factor); learning style preferences and negative user attitude (both user factors); and task interdependence (task factor). Inadequate training was found in Case B, while learning style preference was found to cause an ERP system problem in Case A. Additionally, user lack of individual strength (also resulting from lack of awareness) triggered system non-learnability and system underutilisation. The same applies to learning style preference that affected the system learnability of SAP users in Case A. The factor of task interdependence influenced the collaboration between SAP users that heightened the data quality issue (inaccuracy of SAP data) found in Case B.
Table 6.2: Cross-Case Analysis of Antecedent Factors

<table>
<thead>
<tr>
<th>Antecedent Factors Domain</th>
<th>Common Theme</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORGANISATION</td>
<td>Lack of Technical Support</td>
<td>Insufficient technical expertise provided by the external IT consultant (IT services are outsourced to the third party vendor) Identified to make the SAP system difficult to learn and also lead to system complexity issue which affected user strength and magnitude that caused inaccuracy of SAP data</td>
<td>Insufficient technical expertise provided by the internal IT consultant, heightened by the mobility of the existing internal consultants Identified to lead to untimely, inaccurate SAP data Identified to influence individual strength and lead to data quality problem</td>
<td>Insufficient technical expertise provided by the external IT consultant (IT services are outsourced to the third party vendor) and the internal IT consultant that was set up under Finance and Planning Department Identified to influence lack of individual strength and lead to SAP non-understandability and inaccuracy of SAP data</td>
</tr>
<tr>
<td></td>
<td>Lack of Funds</td>
<td>The company does not allocate adequate funding for SAP system upgrade and customisation Identified to limit the customisation of SAP functions and also lead to system unavailability problems</td>
<td>The company does not allocate adequate funding for SAP training Identified to influence inadequate training and affecting the individual strength/awareness that leads to data inaccuracy and system underutilisation problem</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Lack of Control</td>
<td>Lack of control that is represented by loose control in access security (sharing of SAP ID/passwords) and setting up SAP Profiles -Identified to lead to inaccuracy of SAP data -Also identified to cause system underutilisation problem</td>
<td>Lack of control that is represented by loose control of access security (sharing of SAP ID/passwords) and lacking segregation of duties -Identified to lead to inaccuracy of SAP data -Also identified to influence lack of individual strength that causes system underutilisation and untimeliness of data problems</td>
<td>X</td>
</tr>
<tr>
<td>Antecedent Factors Domain</td>
<td>Common Theme</td>
<td>Case A</td>
<td>Case B</td>
<td>Case C</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------</td>
<td>--------</td>
<td>------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>Inadequate Training</td>
<td>X</td>
<td>Inadequate training offered to SAP users in terms of lacking refresher and comprehensive training - Identified to lead to lack of user awareness/individual strength and in turn, affects SAP data quality (incompleteness)</td>
<td>X</td>
</tr>
<tr>
<td>USER</td>
<td>Lack of Individual Strength</td>
<td></td>
<td>SAP users do not possess self-confidence to do their work using SAP - Identified to lead to inaccuracy of SAP data and system underutilisation problems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of Awareness</td>
<td></td>
<td>Lacking of understanding on how the tasks will be completed by using SAP system - Contributes to system non-learnability, system underutilisation and data inaccuracy problems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative User Attitude</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

User’s negative perceptions and feelings to SAP system usage - Lead to system non-understandability and data inaccuracy issue
<table>
<thead>
<tr>
<th>Antecedent Factors Domain</th>
<th>Common Theme</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td>USER</td>
<td>Learning Style Preferences</td>
<td>The different learning styles favoured by different types of SAP users - Lead to system non-learnability</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TECHNOLOGY</td>
<td>Lack of Technology Affordance</td>
<td>Lack of the functionality provided by technology (SAP) - Leads to system unavailability problem</td>
<td>Lack of technology affordance results in inability to obtain the customised reporting - Leads to system unavailability problem</td>
<td>Lack of technology affordance to provide the link to integrate two modules (FI and CO and PM) - Leads to system unavailability problem</td>
</tr>
<tr>
<td>TASK</td>
<td>Lack of Task Interdependence</td>
<td>X</td>
<td>Lack of task interdependence results in lack of collaboration between users and causes data inaccuracy</td>
<td>X</td>
</tr>
</tbody>
</table>
The analysis revealed several types of **coping mechanisms** employed by SAP users: (1) feral use of information technology (inclusive of feral data), (2) feral information systems, (3) bypass and (4) endurance (ignorance). The third type is the least used coping mechanism and does not form part of the central cross-case discussion. Although the fourth option, ignorance/endurance, is a common way to deal with SAP issues, this mechanism is not central to this cross-case discussion. Emphasis is put on the first and second techniques used to cope with SAP system problems.

First, users of the ERP system in the three companies rely heavily on workaround systems by feral use of information technology to manage the setbacks of the SAP (ERP) system. For instance, the majority of the respondents mentioned the use of Microsoft Excel in performing many aspects of their tasks. The use of this type of coping mechanism either supplants an ERP system function or supplements the limitations of an ERP system (Ignitiadis & Nandhakumar 2009). Alternative software such as Microsoft Excel and Project are identified across the three cases to surmount some of ERP system deficiencies. These are particularly exemplified in the financial areas of Case B, such as for the use of processing petty cash, cashbook and creditor listing, and other related tasks. The use of feral information technology is also quite notable for reporting functionalities. Due to the SAP system's inability to offer a customised reporting mechanism, Excel is used to supplement and/or supplant the reporting function in all three cases. In case A, SAP users depend upon the alternative software (Microsoft Excel and Project). Microsoft Excel is used extensively in Case A because SAP does not have the ability to create or generate reports, while Microsoft Project has the advantage of being able to schedule and plan 'shut down' tasks.

Working around SAP problems through feral use of information technology leads to the generation of 'feral data'. The existence of feral data is evident in all three cases. This is particularly noted in Case C, in the use of a Budget Consolidation Template. This type of coping mechanism acts to supplement rather than to duplicate the SAP function. The Budget Consolidation Template is not a comprehensive or complete system. It pertains to how budget data are stored and prepared outside the SAP environment, resulting in data not being in sync with the data in the formal system.
<table>
<thead>
<tr>
<th>Common Theme</th>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of feral information technology for reporting functionalities,</td>
<td>Use of feral information technology for reporting functionalities,</td>
<td>Use of feral information technology for reports generation and analysis (employing Microsoft Excel, Microsoft Project) Use of feral data (Budget Consolidation Template, IMPS)</td>
</tr>
<tr>
<td>Feral Use of Information Technology (inclusive of Feral Data)</td>
<td>financial process and managing materials (mainly employing Excel</td>
<td>financial process and managing materials (mainly employing Microsoft Excel) - Creation of feral data for Intercompany Transaction</td>
<td></td>
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<tr>
<td></td>
<td>spreadsheet) - Creation of feral data for the Deferred Taxation</td>
<td>- Creation of feral data for the Deferred Taxation Computation</td>
<td></td>
</tr>
<tr>
<td>Feral Information System</td>
<td>System created by end user (Web-Based Bank Reconciliation, Invoice</td>
<td>X</td>
<td>Interface created by end user to link between two different modules of SAP (Integrated Maintenance and Planning Support-IMPS)</td>
</tr>
<tr>
<td></td>
<td>Tracking System)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bypassing SAP</td>
<td>Bypass SAP system protocol in accomplishing the designated task</td>
<td>X</td>
<td>Bypass SAP system protocol in accomplishing the designated task such as processing the taxation and routine tasks for Material Management module</td>
</tr>
</tbody>
</table>
Secondly, another alternative for users to cope with ERP usage problem is through utilising a feral information system developed in-house. This reported coping mechanism was found in Case A. A ‘feral information system’ is a non-sanctioned system and operates outside the ERP system environment. Examples of feral information systems are the creation of an invoice tracking system and web-based bank reconciliation (see Table 6.3). By developing these systems, users duplicate a similar function in the formally sanctioned ERP (SAP) system. Web-Based Bank Reconciliation was created due to users’ unfamiliarity with the similar function in the formal sanctioned system, while Invoice Tracking System duplicated the Vendor’s Monitoring function of SAP. A feral information system found in Case C was Integrated Maintenance and Planning Support System (IMPS). No feral information system was found in Case B.

6.3 A MODEL OF RELATIONSHIPS BETWEEN ERP USE PROBLEMS, ANTECEDENT FACTORS AND COPING MECHANISMS (EUPCOM MODEL)

In case research, it is essential to link the results of the case study analysis to extant literature in order to construct theories. Eisenhardt (1989, p. 545) suggested that the linkage between the results of a study and prior studies would improve internal validity and generalisability. By considering previous findings, the central idea is to consolidate the theory developed to fit the data. Thus, when findings support an emerging theory, confidence in its validity is enhanced, giving it wider generalisability and a higher conceptual level. On the other hand, literature that does not support the theory provides an opportunity to refine and extend the theoretical model (Eisenhardt 1989; Paré 2004).

To enhance the validity of the case study and improve its generalisability, which is limited by the small number of cases, a model has been developed based on the identified factors and important relationships. The EUPCOM Model illustrates the complex relationships between usage problems, the causal factors and the coping mechanisms. Figure 6.1 depicts the proposed model. These relationships lead to a number of propositions that are related to the three research questions, as discussed in the ensuing section, which discusses the model vis-à-vis relevant literature and develops propositions.
Figure 6.1: The EUPCOM MODEL (End User Problem and Coping Mechanisms Model)

- **Antecedent Factor Domain**
  - Lack of Awareness (P10)
  - Lack of Individual Strength (P10)
  - Lack of Technical Support
  - Inadequate Training (P5)
  - Lack of Control
  - Lack of Funds

- **End User Usage Problem Domain**
  - System Underutilisation
  - System Non-Learnability
  - Limited Customisation (P1)
  - Unavailability of Functions (P1)
  - Incompleteness
  - Untimeliness
  - Inaccuracy

- **Coping Mechanism Domain**
  - Poor Interface Design
  - Feral Use of Information Technology

- **Organisation Factor**
  - Lack of Awareness
  - Lack of Control
  - Lack of Technical Support
  - Inadequate Training
  - Lack of Funds

- **Technology Factor**
  - Technology Affordance

- **Data Quality Problem**
  - Poor Interface Design

- **System Utilisation Problem**
  - System Underutilisation
  - System Non-Learnability

- **System Usability Problem**
  - Limited Customisation
  - Unavailability of Functions

- **System Functionality Problem**
  - Limited Customisation

- **Interface Problem**
  - Poor Interface Design

- **Feral Use of Information Technology**
  - Feral Information Systems

- **Feral Data**
6.3.1 End User Problems and Their Relationships

The findings from this study have revealed system functionality as one of the significant problems affecting SAP (ERP) system usage in all three cases. System functionality based on the ISO 9126-1 (ISO/IEC, 1998) refers to the capability of a system to provide functions which meet stated and implied needs when the software is used under specified conditions (what the software does to fulfil needs).

Analysis from the three cases suggested that unavailability of function is a dominant setback faced by the SAP users across the three cases. This problem is based on ISO 9126-1 (ISO/IEC98 1998), which refers to lack of functionality to perform a required task in a timely manner. Functions need to match task requirements while the users need to understand what the functions will do and how to use them to meet their requirements (Faisal, Faridi & Javed 2011).

In this study, the unavailability of functions problem found from the three cases was expressed in many forms. For instance, in Case A, this issue was associated with the weakness of the SAP system in providing customised analysis and reporting functions. Cases B and C demonstrated a similar pattern. For instance, end users in Case B highlighted the absence of a customised format for reporting in the areas of Management and Cost per Unit reporting, which forced users to rely on alternative software. Evidence of this issue was also traced in Case C through the unavailability of customised reporting functionalities for the financial, human resources and supply chain management reports.

The findings from this study also support the previous research that suggested reports generated by the ERP systems fail to provide the format or the data organisation that make the report meaningful or insightful for users (Chen & Law 2009; Holsapple, Wang & Wu 2006). This implies that although ERP (SAP) systems are highly effective for registering transactions and collecting data, they are not very effective at reporting tools or for decision support (Booth, Matolcsy & Wieder 2000; Guo et al. 2012). Similarly Guo et al. (2012) found that the unavailability of customised information needed by management leads to some difficulty for senior managers during decision-making processes. This is because the ERP (SAP) modules implemented by the cases are the ‘data in’ modules that mainly support business operations and daily transaction processing and that provide the current business operations of the job-level data and surface information.
The unavailability of functions problem reported by the three cases can be associated with ERP ‘misfit’, that is, functionality inconsistency between the system and organisational practices (Sia & Soh 2007). In all cases, the lack of functionality forced users from all three cases (A, B and C) to use different approaches to deal with certain tasks. For instance, the majority of users facing unavailability issues cope with the problem by working around the SAP (ERP) system by using feral information technology.

When an ERP system does not adequately fit a company’s current work practices, it creates a gap between the functionality offered by SAP and the requirements of the organisation (Davis 1988; Lucas et al. 1988). One solution for closing this gap requires customisation. However, as noted from the cross case finding, inadequate funds seem to affect the level of SAP customisation and the extent of functionalities that are available in the system. This is in line with previous studies that suggested that embedded business practices in ERP systems, called ‘best practices’, are designated to meet the needs of broad classes of businesses rather than to specifically meet the particular needs of an individual business (Holsapple, Wang & Wu 2006). Therefore, the first proposition is:

**Proposition 1: End users who encounter functional unavailability problem of ERP resulting from limited customisation are likely to employ an alternative system.**

There is a growing body of evidence that shows that providing extensive functionality is not enough. People must understand what the functions do and how to use them. Next, system usability issue is another notable problem observed in all three cases. ISO IEC 9126-1 defines system usability as the capability of the software product to be understood, learned, used, and look attractive to the user when used under specific conditions (the effort needed for use). Usability problems can hamper the extent to which a system can be used to achieve a set of goals within a specified context of use (Singh & Wesson 2009). Users of a system with low usability may experience dissatisfaction with the system that can cause frustration and this, in the long run, will result in users giving up on the system (Anandhan et al. 2006).

Usability attributes are conditions that enhance the system efficiency and functionality. According to the research from the HCI (Human Computer Interaction) field, usability attributes comprise: good design elements, consistent design styles, comprehensive guiding structures, provision of timely and accurate messages regarding system status, shortening response time, reliability of system, consideration of privacy and information security, and
provision of complete services to users (Becker & Mottay 2001). In the ERP research field, Wesson and Singh (2009) proposed a set of ERP heuristics that revealed several common usability issues: navigation, presentation, task support, learnability and customisation. In this study, two usability issues found were system non-understandability and system non-learnability, the latter being the dominant usability issue.

**Non-learnability** is a problematic area within system usability. System non-learnability pertains to a lack of the inbuilt capability that enables users to learn how to use the system. The ERP system is traditionally regarded as being a complex system to learn and to use. Based on ISO/IEC 9126), ‘learnability’ refers to the capability of the software product to enable the user to learn its application. Previous research had suggested that system learnability is an important part of usability (Abran, Khelif & Suryn 2003; Gillan & Bias 2001; Jones 1997). For instance, Jones (1997) believed that usability is the total effort required to learn, operate and use software or hardware. In this study, system non-learnability is one of the identified usability problem found from both Case A and Case B. When end users do not really understand how to use SAP and need a lot of effort to learn it, they are unable to choose and use the correct SAP functionalities. This leads to system underutilisation, delay in transaction processing and inaccuracy of data entered, since they are unable to get their work done quickly.

This finding is in agreement with the studies by Singh and Wesson (2009) and Topi, Lucas and Babaian (2005). Topi, Lucas and Babaian (2005) suggested that a usability problem identified by users increased the amount of time it took them to learn how to use the system and delayed transaction processing. Similar findings were suggested by Scott (2005): that learnability indicates easiness of learning a system so that it would speed up users’ work.

Another notable finding from the cross-case analysis is **system underutilisation**. This issue seemed to affect the majority of the end users from the three cases. The underutilisation problem found across the three cases was due to the underuse of ERP system functionalities. This is in line with the findings of Jasperson, Carter and Zmud (2005) that suggested that system underutilisation is ascribed to SAP system features that have not been exploited by end users.

One of the critical goals in implementing an information system such as ERP is to ensure that the technology’s intended level of usage is achieved (Amoako-Gyampah 2007), which is reflected through system usage. Further, they argued that system usage is a manifestation of the acceptance of the technology by the users. Thus, a system cannot be considered
successful if the technology is not used or the intended level of usage is not achieved. Similarly, in the general IS research field, Davis, Bagozzi and Warshaw (1989) noted that ‘computer systems cannot improve organisational performance if they are not used’ (p. 982).

The findings from this research as discussed from the cross-case comparison corroborate previous work that suggested that, despite impressive advances in ERP capabilities and functions, the functional potential of ERP functionalities is still underutilised (Brehm, Heinzl & Markus 2001; Yaseen 2009). In accordance with Ross and Weill (2002), an underuse problem means that users may use only a limited number of available features or seldom apply task-related features of the ERP system to their relevant operations. Therefore, although the potential of ERP systems is great, users frequently take advantage of only the most basic capabilities of the system (Amoako-Gyampah 2007). In this study, the reported underutilised issues of the ERP system limited users’ knowledge of the system, which affected their confidence level not only in using the system but also in learning how to use the system further. This was portrayed in their limited capability to profoundly explore the ERP system. Additionally, the poor system design of ERP further intensified the underutilisation issue that is discussed next. Therefore, the second proposition is:

**Proposition 2: End users who encounter system usability issues (non-learnability) and are more likely to underutilise the ERP system.**

The system interface is part of the human interaction with technology that facilitates information-seeking and exploration of the system features. ‘Interface characteristics’ refer to the interaction between the system and users. These interfaces are designed to aid users’ understanding in using the system (Wang, C-H, Liao & Chu 2011). The analysis showed that an overwhelming majority of users felt that the design of SAP’s screen is unattractive, contains a lot of unfamiliar symbols and jargon, is text intensive and uses an old-fashioned layout. Some of the SAP users from the three cases believed that the existing SAP screen layout was unable to capture their interest in the system due to the absence of interactive pop-up menus, the extraneous layout and the uncustomised screen design.

For example, an interviewee from Case A mentioned the jargon used in preparing a purchase requisition, which she considered to be useless. An additional illustration of the interface issue is the need for a more user-friendly interface. The complexity of the existing interface design is considered problematic for both experienced and novice users, who require a friendlier interface and screen design. In another example, a senior manager of the
MIS and SAP Department of Case C acknowledged the excessive screen design of SAP which has many fields to be filled.

This study produces results that support the findings of previous researchers that usability of a system is associated with the interface design. This is because usability is directly judged by the user interface design of a system. According to Mohamed et al. (2010), the information technology used in an ERP system should be easy to use by end users. With regard to this study, the reported system usability issues such as system non-learnability and system underutilisation are greatly influenced by poor interface design. System complexity and poor interface design faced by end users discourage them from learning the SAP system deeper and hence aggravates the underuse of the ERP system problem. This also accords with the earlier observations of other researchers that users should be given a user-friendly interface covering convenient formats for input and output of information for making efficient use of the system (Singh & Wesson 2009) and that there is a strong relationship between user guidance and usability of systems (Lin, Choong & Salvendy 1997).

Interface design issues noticeably affect users’ motivation in using SAP; hence, they also discourage positive post-adoption behaviour. In line with previous studies conducted in the area of ERP research training, a user-friendly and easy-to-use interface seems to increase ERP system efficacy and system usability (Choi, Kim & Kim 2007; Lim, Lee & Nam 2007). These results strengthen the argument that easy-to-understand error messages, the possibility to do useful work with programs that have not been learned before, the availability of a feature to undo reverse control actions, and confirming questions before execution of risky commands may help to increase both perceived usefulness and learnability. Thus, discussions on the system underutilisation and interface problems lead to the third research proposition:

**Proposition 3: End users who experience that ERP interface is poor and unfriendly, encounter system usability issues (non-learnability) and more likely to underutilise the ERP system.**

Another important finding of this study is the identification of data quality (DQ) issues as the crucial problem encountered by SAP users during the post-implementation phase. Data quality (DQ) is central to the ERP operating processes where it facilitates decision making and inter-organisational cooperation (Batini et al. 2009). This finding is also in agreement with previous work conducted in this field that identified data quality factors as contributing to
under-performing of ERPs (Calisir & Gurel 2003). The review by Momoh, Roy and Shehab (2010) postulated that poor data quality (DQ) is one of the nine critical factors associated with ERP system failures. There were three data quality issues: (1) inaccuracy of data, (2) untimely data and (3) incompleteness of data. However, only inaccuracy of SAP data triggers the severity issues across the three cases in this study.

**Data inaccuracy** refers to the mismatch between SAP data and reality elsewhere (Ballou & Pazer 1985). Wand and Wang (1996) further refined the notion of accuracy to include the idea that the information is not only correct, unambiguous and objective, but also meaningful and believable. Information must not only be accurate, but must also be perceived to be accurate (Wang, RY, Strong & Guarascio 1996). The extent of data inaccuracy issues was evidenced in various ways. For instance, in the Engineering and Service Department of Case A, inaccuracy of data in a few areas affected the detailed analysis of equipment faults, as discussed in detail in the cross-case analysis. For Case B, the inaccuracy of data resulted in overpayment to the company’s suppliers. Data inaccuracy problems reported in managing the Bill of Material (BOM) for the back flush process, processing the payment for the vendor and planning of production led to inaccurate input for the subsequent processes. For Case C, a similar type of data problem was shown through discrepancies between actual stock items and virtual stock items.

Since ERP modules are intricately linked to each other, inaccurate data input in one module may negatively affect the functioning of other modules (Park & Kusiak 2005). The view of Park and Kusiak is also consistent with the results found by Xu et al. (2002), whereby a problem in the data quality could cause disaster for the ERP (SAP) system due to its integrated nature. A similar view was shared by Umble, Haft and Umble (2003), who believed that when someone enters the wrong data, the mistake can have a negative domino effect throughout the entire enterprise due to the system’s integrated nature. Additionally, inaccurate data quality also suggests that it is impossible to build trust or confidence in the data, and the result may be a lack of user acceptance of any initiatives based on such data (Friedman et al. 2006). Therefore, educating users on the importance of data accuracy and correct data entry procedures should be a top priority not only during the ERP implementation stage (Stedman 1998; Stein 1999) but also during system use (Haug & Arlbjørn 2011).

Besides the data inaccuracy issue, data quality issues revealed from the case studies includes untimeliness problems. The **untimeliness** of data refers to the recorded data being out of date (Ballou & Pazer 1985). Users may have different demands for currency and as a
consequence, information that is viewed as current for one task may be viewed as too out of date for another. User perceptions of currency relative to the task demands will over time be an important determinant of information quality. The untimeliness (non-currency) issues found in this study are exemplified through delay in data entry by the receiving unit of the Purchasing Department, which consequently resulted in discrepancies between the recorded data of SAP and the actual inventory. The findings of this study seem to be consistent with those of other studies and suggests that lack of timeliness of data entered into the system leads to data inaccuracy (Wand & Wang 1996). Hence, when ERP (SAP) users do not key in the specific costs in a timely manner, this definitely affects subsequent processes by causing inaccuracy of SAP data. The data quality problem discovered in this study had disrupted the consistency of information delivered throughout Case B; the organisation was unable to get timely and useful information. As suggested by Wang and Wand (1996), wrong states, meaningless states or ambiguous states may occur when the component operates properly but is not updated at the same time.

Besides accuracy and timeliness, the quality of information could also be shaped by completeness. Thus, the third aspect of data quality issues observed in this study is incompleteness of SAP data, which refers to omission of data or missing data entered into SAP (based on Ballou & Pazer 1985). According to Nelson, Todd and Wixom (2005), it is important to recognise that the assessment of completeness can only be made relative to the contextual demands of the user. Hence, the perception of completeness may vary from one user to another. The system may be complete as far as one user is concerned, but incomplete in the eyes of another.

Incompleteness of SAP data was reported in case B (For the detailed description, refer to Section 5.4.3.2). Consequently, insufficient SAP data for costing a bill of material led to manual processing, and the taxation information entered into the system was not captured. Data that are untimely and incomplete become inaccurate. The findings on data quality are aligned with the findings by Nelson, Todd and Wixom (2005), which suggested that information quality measures include currency (timeliness), accuracy and completeness. The findings from this study also support previous research. For example, Lin (2010) argued that if the information provided by an ERP system is up to date (timely), accurate, complete and well formatted, a faster task performance can be achieved and employee productivity can be increased. In our context, adverse effects of SAP system usage have been identified, such as the delay in transaction processing and duplication of data entry due to problems with the data quality. Thus, the fourth proposition is:
Proposition 4: End users who encounter data incompleteness and untimeliness problems are also more likely to face data inaccuracy.

6.3.2 Antecedents of Problems and Their Relationships

Organisational factors are the most common reasons for usability and utilisation problems. First, inadequate funds contribute to inadequate training that in turn influence users’ awareness and individual strength to learn, understand and utilise SAP. This relationship is simplified below and leads to proposition 5:

Lack of funds → Inadequate training → Lack of awareness/ lack of individual strength → System non-learnability → System underutilisation

This finding is identical with the study done by Amoako-Gyampah & Salam (2004), which suggested that training represents a high component of the implementation budget and might be cost prohibitive when a longer period is taken than required. Training is a key issue not only during the implementation phase, but also in the use phase (Yu 2005). The need for employee training was illustrated in the case study of Maguire, Ojiako and Said (2010), where about half of the employees felt that the new ERP system was difficult to use due to lack of the required training. Training conducted during the post-implementation phase facilitates usage of the ERP system and stimulates the user's interest to continue using the system in the long term (Jones et al. 2001).

According to the relationship noted above, lack of training results in lower SAP user knowledge and SAP skills that aggravate the understandability and learnability problems of SAP. This finding supports previous a study which argued that lack of training discourages users from using the system (Chang, M-K et al. 2008). Besides that, inadequate training provided in the early phase of SAP implementation (project phase) may lead to many usage problems in the subsequent phase of shakedown or even the post-implementation phase (Markus et al. 2000). Thus the fifth and sixth propositions are:

Proposition 5: Organisations that lack resources would not be able to provide sufficient training to enhance end users’ attitudes and knowledge and to build their confidence, skill and ERP strength.
Chapter 6: Discussion

Proposition 6: End users with lack of individual strength is more likely to cause system-related problems (usability and underutilisation issues)

Second, lack of support erodes users’ confidence and strength, and aggravates system complexity, leading to problems of system usability (non-learnability), underutilisation or data quality (inaccuracy, untimeliness). The relationship is summed up as follows and leads to Proposition 5:

\[
\text{Lack of technical support} \rightarrow \text{Lack of individual strength} \rightarrow \text{system usability} \rightarrow \text{system underutilisation/ Inaccuracy of data}
\]

From the cross case-analysis, all three cases encountered either system or data quality problems that were due to lack of support. Mixed results were found with regard to this antecedent factor. While lack of technical support in Cases A and C pertains to external expertise or support team, in Case B, SAP users did not get adequate support from their internal expertise. Hence, this finding from this study confirms prior research on the importance of adequate support from the external support team (Longinidis & Gotzamani 2009). Given that ERP is a complex package with a level of functional interoperability incomparable to what is found in most stand-alone IT systems, organisations tend to rely on external expertise for help in developing, implementing and maintaining such systems in their setup (Ko, Kirsch & King 2005). The same is true at the post-implementation stage when the effectiveness of the adopted systems is assessed (Amoako-Gyampah 2007).

In addition, the finding of the study on the influence of support services on the user’s learnability and understandability is also consistent with the previous literature. For example, end users who have a basic understanding of computers and IT skills have an advantage in learning and absorbing new ERP knowledge and ultimately find such systems easy to use or learn (Amoako-Gyampah 2007; Wu & Wang 2007). Analyses from these case studies suggested that system non-learnability, complexity and underutilisation problems are influenced by low confidence to use SAP, which is derived from insufficient support by third party vendors. Moreover, prior research has confirmed that the quality of external expertise has a positive relationship with IT system success (Bajwa, Bajwa & Brennan 1998; Thong, Yap & Raman 1996) and the use of ERP systems (Ifinedo 2011a; Ifinedo & Nahar 2009; Ko, Kirsch & King 2005). For instance, Ifinedo (2011a) suggested that external expertise (an exogenous factor) and internal computer/IT knowledge (endogenous factors) are pertinent to the success enhancement of ERP systems for adopting organisations.
Inadequate support is also associated with **insufficient technical expertise** provided by the **internal IT consultant**. This is observed from the analysis of the findings of Case B, whereby untimeliness and incompleteness of SAP data that originated from lack of individual strength is mainly influenced by these antecedent factors (see the detailed analysis in Section 5.3.4.1.) The outcome of this study consistently supports the view by Ifinedo (2011b) that in-house computer/IT skills are indeed pertinent to ERP system success in adopting organisations, and also the view expressed in previous literature that there is a positive relationship between organisational IT professionals’ skills and the effectiveness of ERP applications (Ifinedo & Nahar 2009). Thus the seventh proposition is:

**Proposition 7: Users who do not receive adequate internal and/or external support lead to their lack the confidence and strength to learn, understand and utilise the system fully and in a manner that ensures data quality.**

An ERP system is an ideal control technology since SAP emphasises the standardisation, streamlining and integration of the business process. ERP systems and integrated systems must have the highest levels of integrity and controls. However, the analysis of the findings (see Table 6.2), reported **lack of control** as the common antecedent factor that caused a data quality problem in both Case A and Case B. SAP user in these two cases highlighted loose control pertaining to the access control. This antecedent factor could eventually jeopardise the accuracy of ERP data.

Access control constrains what a user can do directly, as well as what programs executed by the users are allowed to do (Sandhu & Samarati 1994, p. 40). They added that the purpose of access control is to limit the actions or operations that a legitimate user of a computer system can perform. In this way, access control seeks to prevent activity that could lead to a breach of ERP system security. Restricting access is a fundamental internal control, and yet one of the most difficult to be achieved in a complex environment such as an ERP system. Essentially, access control in ERP should be implemented by user authentication of the username and password that are assigned to the authorised users. Authentication is the verification process of users, programs and services (Ali & Hasan 2010). According to Ali and Hassan (2010), this process is performed to ensure that authentic users are the same people as those they claim to be and are eligible to access the system. Thus, authentication acts as the cornerstone of any security infrastructure or related technology.
ERP’s Standard User Authentication verifies a user’s identity through the use of logon passwords. Unsuccessful logon attempts cause the session to terminate and activate user locks. As standard security measures, users have to provide several logon profile parameters and an initial set of password rules that expands according to user needs. This type of access control specifies users’ rights to access different screens, data and processes in the system. The use of usernames and passwords also means that the user’s actions are recorded on the system. Therefore, an authorised person is able to view an individual’s actions when logging on or entering data into the system at any time.

The lack of access control is illustrated through the sharing of SAP IDs and passwords by users in Cases A and B. Sharing a SAP user ID and password was intended to overcome the underuse of the ERP system in both cases. However, this practice eventually leads to the control issue of authorisation, which is the process used for determining what accesses or privileges are allowed for users (Ali & Hasan 2010). Authorisations are enforced by means of access controls, which restrict user accesses. In the all ERP systems, standard user authorisation secures user access to business data and transactions, ensuring that only authorised users gain access to certain data and processes. Assigning access to only the appropriate users reduces the risk of errors, since only knowledgeable users are granted access. The risk of fraud or irregularities is also reduced, as it is much easier to monitor a limited group of users rather than the whole user base.

Lack of control as discussed above leading to data quality problems as shown in the EUPCOM model (Figure 6.1). This is in line with Xu et al. (2002), who suggested that lack of control could degrade the data quality in the ERP environment due to its integrated nature, while in a non-integrated system it might cause only minor problems. This is because as a system is integrated, any data error could pass through the whole system unnoticed. Moreover, ERP was also found to be too complex and inflexible, requiring more controls on data quality and more skills to operate. Hence, the eighth proposition is:

**Proposition 8:** Lack of control by an organisation in order to resolve underutilisation of the ERP system is likely to trigger data quality issues.

For the **user dimensions**, the two apparent antecedent factors revealed from the case studies are: (i) lack of individual strength and (ii) lack of awareness. First, **lack of individual strength** seemed to strongly affect system usability and SAP data quality across all three cases. The relationship between user’s lack of confidence, system usability and data quality problems is captured as follows:
Lack of individual strength $\rightarrow$ System Non-learnability $\rightarrow$ System underutilisation

and

Lack of individual strength $\rightarrow$ Untimeliness/incompleteness of data $\rightarrow$ Data inaccuracy

The above result may be explained by the fact that users lack SAP knowledge or basic computer skills that are essential in using the system. In gauging efficacy, individuals assess their skills and their capabilities to translate those skills into actions. Hence, greater computer self-efficacy contributes to users’ perceptions of their ability to use SAP effectively. On the other hand, the absence of computer experience reduces the users’ self-confidence. This is because users who are computer illiterate tend to perceive SAP as being complex and difficult to use, as demonstrated from the findings of the case studies. Quoting from one of the examples from the findings analysis, one of the participants suggested that minimum interaction with SAP resulted from difficulty in learning the SAP system. This originates from the lack of self-confidence in executing tasks via SAP. However, some users, although not heavy users of SAP, are still unable to fully internalise SAP knowledge.

Similar findings were seen in the study by Kwahk and Ahn (2010), who suggested that when individuals believe they are able to use computers and IT with great skill, they are more likely to expect beneficial outcomes from using computers and IT compared to individuals who doubt their computer capabilities. Since ERP systems are considered technologically sophisticated information systems, they require more technical knowledge than traditional transaction-processing systems. Kwahk and Ahn (2010) further suggested that technical knowledge, which is usually learned through education and training, is likely to be acquired more effectively and efficiently when users’ self-efficacy for using computers and information technology is high, rather than when users are reluctant to use them due to the lack of computer self-efficacy. In using integrated systems like SAP, computer self-efficacy may play a more critical role than in using other IT-based systems, since the technological complexity of ERP systems is generally high (Bueno & Salmeron 2008).

The findings for this present study also reveal that the individual factor does play an important role in supporting the utilisation of learned skills. Hence, it supports the argument of previous research that a high user confidence level to use the computer at work has a positive influence on learning performance (Hassan 2006) and computer utilisation (Liu et al. 2011). According to Liu et al. (2011), confidence is most likely represented by the cognitive domain of attitude. By examining the strengths of different components of attitudes to
computer utilisation, their results showed all attitude components (anxiety, liking, confidence and usefulness) to be significantly associated with computer use. Moreover, past experience with computer systems provides end users with self-assurance and minimises the anxiety associated with the fear of failure or the inability to utilise enterprise systems (Wang, C-H, Liao & Chu 2011). This leads to the ninth research proposition:

Proposition 9: End users who lack of the right attitude, ability, knowledge or skill are likely to cause and/or encounter more data quality problems and usability issues than users with the right attitude, knowledge, ability and skill.

Second, within the same dimension, lack of awareness is noted to directly contribute to SAP data quality issues such as untimeliness and inaccuracy. This antecedent factor of lack of awareness also seems to influence the users' lack of individual strength that caused system usability issues, as discussed above. The definition of 'lack of awareness’ offered in this study is based on that of Gutwin, Stark and Greenber (1995), who suggested four awareness concepts: social awareness, task awareness, concept awareness and workspace awareness. The task awareness pertains to how a task could be accomplished (Gutwin, Stark & Greenber 1995). With regard to this study, lack of awareness indicates users' lack of a SAP user’s attentiveness to how their tasks will be completed by using SAP.

In the current case, the capabilities of the SAP system was not properly appreciated; therefore, any potential transformational aspects remained relatively unexplored. A low level of awareness was evidenced among SAP users in both Case A and Case B. In these two companies, the users seemed unable to understand the full capabilities of the system. The inability to identify what the system is capable of doing led to underutilisation issues. Lack of awareness contributes to users’ low self-confidence; hence, it influences their use of the system, leading to the data accuracy issues of untimeliness and inaccuracy. The EUPCOM model captures the relationships that could be presented as follows:

Lack of awareness ——— Data inaccuracy/Data untimeliness

And

Lack of awareness ——— lack of individual strength ——— System non-learnability

—— System underutilisation/Data inaccuracy/Data untimeliness

The above relationships lead to the tenth research proposition:
**Proposition 10: Users who possess greater awareness are likely to have a better understanding and greater utilisation of the ERP system.**

The next category of antecedent factors in the technology dimension is *lack of affordance*. It signifies the inability of the SAP system to provide the functionality required by users. The definition of ‘affordance’ is given in Table 3.3.

Findings from previous studies have suggested that the affordance concept is the result of the intertwining of IT and organisational features (Boudreau & Robey 2005; Zammuto et al. 2007). Zammuto et al. (2007) suggested that the technology organising possibilities that are referred to as affordances for organising depend not only on the functionality characterising the information technology but also on the expertise, organisational processes and procedures, controls, boundary-spanning approaches, and other social capacities present in the organisation. They further argued that, *one cannot talk about a complex technology without reference to the social setting, just as it makes limited sense to talk about a door handle without discussing the people opening the open doors* (Zammuto et al. 2007, p.753).

Similarly, ‘affordance’ in Boudreau and Robey’s (2005) definition is the notion that technology is enacted from an evolving human agency but may also constrain that agency. Possibilities of action are not given but depend on the intent of the actors enacting them. Thus, an ERP system (in terms of hardware and software) implemented in a leading-edge manufacturing organisation may develop into different practices of organising than would the same system implemented in a resource-poor organisation possessing little experience with IT.

However, the findings of the current study do not support the previous research on this issue. The findings analysis did not demonstrate any relationship between lack of technology affordance (technology dimension) and the other antecedents such as lack of individual strength (user dimension) or lack of funds and training (organisational dimension). This lack of relationship can be seen in the EUPCOM model in Figure 6.1, where there is no relationship between the lack of affordance factor and the other two factors (organisation and user). Yet, lack of affordance does seem to contribute to the system functionality problem. In this study, lack of technology affordance results in the unavailability of the required functionalities of the ERP system across the three cases. To cope with this issue, SAP users shifted to the alternatives discussed above (feral use of Information technology, feral Information system or feral data). This next proposition is:
Proposition 11: Lack of technology affordance causes unavailability of the required functionalities, leading to the employment of an alternative system.

6.3.3 Coping Mechanisms and Their Relationships

The final aspect of the usage problems in the EUPCOM model is the coping mechanism. When ERP users face problems, they might not necessarily rely on the main system (SAP) sanctioned by the organisation but rather develop their own systems or databases, work around the system or even replicate some of the ERP system functionalities. One of the important criteria of coping is an ‘effort to manage’ a situation (Lazarus & Folkman 1984, p. 142). With regard to this study, ‘coping mechanism’ implies techniques employed by end users to overcome SAP usage issues that occur during the post-implementation phase of the SAP (ERP) system’s life cycle. Previous studies have identified two types of coping mechanisms: the emotion-focused form and the problem-focused form (Lazarus & Folkman 1984) (see Section 2.4 for a detailed description).

Judging from the evidence from the case studies, a few coping mechanisms are widely used by the SAP users to cope with the SAP issues already discussed. The coping mechanisms do not just resolve some of the identified problems (system unavailability, system complexity, data quality and interface) but also contribute to other usability issues such as system underutilisation and data quality. All three cases reported on the two forms of coping mechanisms: problem-focused and emotion-focused coping.

The emphasis of this study is mainly on problem-focused coping mechanisms rather than emotion-focused. This is because with the deployment of a SAP system, the employees in all three cases are required to work with this integrated system and not around the system. Since SAP is a mandatory system, the management team tries to ensure that end users continue using it despite the problems they might encounter, as argued by Amoako-Gyampah (2004). In this study, it was observed that some end users just ignore or endure a problem (emotion-focused coping). By doing this, no action is taken to remedy the problem related to system, data, interface or infrastructure. Hence, this type of coping mechanism is ineffective in solving a usage issue and so has been argued as not being a true coping mechanism due to its inactive role (Benamati & Lederer 2001). Lack of resources (such funds and technical support), as seen in the EUPCOM model, worsen the situation where end users view ignoring or enduring a problem as the safest way to deal with their usage issues. This unfavourable implication is supported by a prior study showing that inaction or
endurance had a statistically significant negative correlation with the reduction of problems (Benamati & Lederer 2001) and is typified by the lack of adequate resources to address the problem (Benamati, Lederer & Singh 1997). Inaction or ignoring the problem was the most prevalent option due to the fact the ERP system was mandatory in all three cases.

Apart from emotion-focused coping, findings from the case studies reported on the use of problem-focused coping mechanisms in solving SAP system usage problems. Two types of coping mechanisms were found within this form: feral use of IT (including feral data) and feral information system. The commonest examples are evident in the use of Microsoft Excel or Microsoft Project for generating customised reports, analysis and planning. The possible explanation for this coping mechanism is the unavailability of SAP scheduling and planning functionalities in Case A. In addition to that, Microsoft Excel is used extensively in all cases to overcome the unavailability of customised reports. This personal software has also affected financial processes and material management across all three cases.

Findings from this case study extend previous research on feral system (Houghton & Kerr 2006; Kerr & Houghton 2008, 2010; Kerr, Houghton & Burgess 2007; Urus, Molla & Teoh 2011b) by proposing that a feral system is a source of problems (such as data quality and underutilisation) as well as a coping mechanism for SAP-related problems. In a similar vein, Ignatiadis and Nandhakumar (2009) reported on the feral use of IT (Excel) for report generation, further processing of data produced by SAP and as a medium of communication, which resulted in portraying a false picture of the company. This finding is further supported by Kerr, Houghton et al. (2007), who highlighted the widespread use of Microsoft Excel and Access for planning outside the SAP system environment.

Adopting the feral use of information technology by using programs such as Excel is the convenient way, since they reside on most users’ desktops and have an environment that the user can easily navigate (Raden 2005). The Excel spreadsheets are suitable for creating report analyses on historical data. A ‘workaround’ feral system is similar to shadow IT, which is people or a system performing IT functions but not being part of the mainstream IT organisation (Raden 2005). Raden added that the existence of shadow IT may imply failure on the part of the IT services to meet the clients’ needs and that the problem is universal. Shadow IT does not usually attempt to do the core IT processes such as networking or security, or even core applications as in an ERP system. For the most part, shadow IT fills in the blanks not provided by the IT, such as reporting, specialised modelling and data captured from external sources.
Feral use of information technology is also intended to overcome some data-related issues in all three cases. For instance, Microsoft Excel is used to cope with the untimeliness of Petty Cash Report in Case B, while Creditors Aging is used to overcome data incompleteness problems. This is because in SAP, some of the figures required in the Creditors Aging report are not fully captured in the SAP system. Interestingly, the analysis of findings also suggests that data inaccuracy problem faced by SAP users from the three cases is partly due to the use of feral information technology.

Besides feral use of information technology, another medium of coping with SAP is the use of feral information systems. The characteristics of feral information systems are that they are reasonably well built, have some degree of sophistication in their functionality, and provide mechanisms for inputting data, processing it and extracting output. A feral information system is usually a non-sanctioned system and operates outside an ERP system environment. An example of a feral information system reported in the literature includes Webfuse, a learning management system that provides most of the functionalities of commercial learning management systems (Behrens 2009). Feral information systems as a way to deal with the issues arising from SAP was found in Cases A and C. The evidence from this case study suggests that SAP users from Case A depend on their own developed systems such as Web-Based Bank Reconciliation and Invoice Tracking System to overcome system complexity issues. The unavailability of links forces users to create IMPS in Case C. A similar finding was revealed by Behrens (2009), who believed one of the reasons for implementing a feral system is to minimise system complexity.

Among the advantages of feral information systems such as Web-Based Bank Reconciliation, Invoice Tracking and even Webfuse are their abilities to foster creativity via perceived innovative qualities and their ability to bring about stability and order (Behrens 2009). The creative works are not only novel (i.e., unique, original and unexpected) but also appropriate (useful and valuable) (Sternberg & Lubart 1999).

Nevertheless, for SAP users in Case B, there are no traces of feral information system usage. This situation indicates that users in this organisation do not dare to take risks by developing their own non-sanctioned information system to resolve any SAP issues. Based on the above discussion, the following propositions are put forward:

**Proposition 12:** ERP end users who encounter system, data and interface problems and who have low computer self-efficacy are likely to create feral use of information technology as the coping mechanism.
Proposition 13: ERP end users who encounter system, data and interface problems and who have high computer self-efficacy are likely to create a feral information system as the coping mechanism.

Feral information system and feral use of IT as the coping mechanisms can lead to the creation of feral data. As shown in Figure 6.1 of the EUPCOM Model, feral data is not a coping mechanism itself but is an element of the feral use of information technology employed by SAP users, as discussed in Section 6.3.3.1. In this study’s context, ‘feral data’ refers to data that is stored outside the formal sanctioned system (such as ERP).

As noted from the cross case-analysis, the emergence of feral data in overcoming SAP usage issues is found in all three cases (Cases A, B and C). For Case A, the employment of feral data shows in the deferred taxation computation that is carried out by using Excel because a similar calculation function could not be performed by using SAP. In Case B, the creation of Intercompany Transaction indicates the existence of feral data. This transaction refers to the expenses paid by the parent company which belong to their subsidiaries, or vice versa. Due to this function not being supported by SAP, an Excel spreadsheet is used for monitoring the process, resulting in data stored in Excel outside the SAP environment. Another example of feral data occurs in the use of the Budget Consolidation Template in Case C that captures and accumulates budget data.

The examples described above are regarded as feral data. The present findings accord with earlier observations that users often extract data from the formal system (ERP) and make necessary adjustments or modifications in order to suit their needs (Kerr & Houghton 2008; Kerr, Houghton & Burgess 2007). However, when such users fail to integrate the data back into the formal system for operational, forecasting or knowledge management purposes, the data become out of sync with the formal systems and become feral data. The findings of this study are consistent with those of Kerr and Houghton (2010), that discussed ‘grass stock’ as an example of feral data which was different from the data reported in ERP system, leading to inaccurate forecast and business analytics outputs (Kerr & Houghton 2010).

From the EUPCOM Model, the use of feral data is mainly to resolve system unavailability issues encountered by SAP users. Therefore, the final research proposition is:
**Proposition 14:** ERP end users who create feral information technology in resolving unavailability functions of ERP system are likely to contribute to the development of feral data, which in turn aggravates data inaccuracy issues.

6.4 SUMMARY OF THE CHAPTER

This chapter started with a general description of within-case analysis. Then cross-case analysis was presented by discussing area of similarities and differences between the three cases. The cross-case comparison revealed the three major ERP system problem areas of system, data and interface. From the comparison across cases for the antecedent factors, the three prominence factors found were lack of technical support, lack of individual strength and lack of technology affordance. The results for cross-case comparison of the coping mechanisms identified three main types: feral information system, feral use of IT and feral data (derived from feral use of IT). System bypass was also revealed as another coping mechanism used by some ERP users. The chapter continued with the development of the EUPCOM model (End User Usage Problems and Coping Mechanisms). From the discussion of the EUPCOM Model themes and construct, 14 research propositions were developed.

In the following chapter, the conclusion will be presented by revisiting the research questions posed in Chapter 1. Chapter 7 also covers the contribution of this research and its limitations, and avenues for future research.
Chapter 7

CONCLUSION

7.1 INTRODUCTION

The unique contribution of this thesis culminates in the development of the EUPCOM Model described in Chapter 6. The purpose of this chapter is to provide a summary of the key findings by revisiting the research questions and conceptual framework. The chapter also covers the contributions and limitations of this research, and areas for further research, along with final concluding remarks. The remaining part of the chapter is organised into five other sections. Section 7.2 revisits the main research question and the three sub-questions formulated in this thesis. The discussion continues with a review of the conceptual framework (7.3). Following that, the theoretical and practical contributions of this thesis are presented (7.4). Section 7.5 describes the limitations of this study and suggests avenues for future research. The chapter is summed up with concluding remarks in section 7.6.

7.2 REVISITING THE RESEARCH QUESTIONS

Post-ERP-implementation research, especially on the usage and evaluation phases, is starting to gain importance (Botta-Genoulaz, Millet & Grabot 2005; Esteves & Bohorquez 2007; Grabski, Leech & Schmidt 2011; Moon 2007; Schlichter & Kraemmergaard 2010). There is therefore a need for research to understand the problems ERP users face in using the system, the causes of those problems, and how they cope with those problems. This thesis set out to contribute to the post-implementation ERP literature by answering the main research question of:

*What kind of problems do users encounter in using an ERP system, and how do users cope with ERP usage problems?*

In order to answer the main research question, the study aimed to answer the three sub-questions as presented in Section 1.3.
**Question 1: What kind of problems do users (operational, supervisory and managerial) face in using ERP systems during the post-implementation phase?**

The prior research on adoption of ERP provided some insight as to the difficulties and challenges that end users encounter in using ERP systems. Hence, in addressing the first research sub-question, analysis of 30 interviews from three organisations in Malaysia were carried out using the open coding techniques as proposed by Strauss & Corbin (1998) (see chapter 4.6.2.1). The result shows that ERP end users frequently encounter system, data, technical and interface problems. System problems cover system complexity, unavailability of functions, non-interoperability, non-understandability, non-learnability and underutilisation. Data problems cover untimeliness, inaccuracy and incompleteness. Technical issues refer inadequate infrastructure. Interface problems cover poor quality of the ERP input-output screens. These problems do not occur in isolation but rather are interrelating between one another to form complex relations (refer to Table 6.1 and chapter 6.3.1).

**Question 2: Why do users (operational, supervisory and managerial) face problems?**

To address the second sub-question, the literature review has identified organisational, users, technology and task categories of the antecedent factors. The specific constructs for these four factors were derived from the Gap Framework (Behrens & Seder 2004), the Task-Technology Fit (Goodhue & Thompson 1995) and Computer Self-Efficacy (Bandura, A 1989; Marakas, Yi & Johnson 1998). The analysis of the interview data using a thematic analysis approach (Boyatzis 1998) confirmed that the four categories were sufficient. These antecedent factors have a complex relationship both with each other and with end users problems (refer to Table 6.2 and Section 6.3.2).

**Question 3: How do users (operational, supervisory and managerial) cope with ERP usage problems?**

To answer the third sub-question, the investigator reviewed the previous literature. In addition to the data analysis from the main study, data were also derived from the exploratory study to establish the coping mechanisms employed by ERP system users in dealing with problematic system issues. The review of previous literature suggested three strategies employed by users in coping with issues in information system usage: improvisation (Monteiro, Jarulaitis & Hepso 2012; Magni et al. 2010), adaptation (Beaudry & Pinsonneault 2005) or ignore/disregard/endure (Benamati & Lederer 2001). However, these
strategies are not specifically related to the coping mechanisms employed by end users in dealing with ERP system issues. Due to the limited literature on the perspectives of ERP system users, an exploratory study was carried out to establish the coping mechanisms. The analysis of data from the exploratory study suggested the use of ‘feral systems’ as a coping mechanism. Under the umbrella of feral system, two types of coping mechanisms were identified: (i) feral information system and (ii) feral use of information technology (including feral data as a by-product of feral IT). The findings also revealed two other types of coping mechanism: endurance (ignorance) and bypassing. Those are not central to this study, as explained in the cross-case discussion in Section 6.2.

Thus, in answering the third sub-question, the thesis offers an insight into unintended use patterns or undesirable routine use by users in coping with encountered problems. The coping strategies of abandonment (discontinuing the use of ERP) and disregard (considered as a common way to deal with SAP issues), are not central to the thesis. Rather, the emphasis is on the three techniques used to cope with SAP system problems because ERP is a mandatory system (see, eg. Bagchi, Kanungo & Dasgupta 2003; Brown & Lockett 2004) and end users cannot afford the options of discontinuing using the system or switching to a totally new system (DeLone & McLean 1992) as their coping mechanism.

7.3 REVISING THE INITIAL CONCEPTUAL FRAMEWORK

The premise of this research is based on the fact that end users encounter numerous ERP usage issues that hinder effective use and militate against the promised ERP system benefits during the post-implementation phase. Thus, it is important to identify the usage issues. to determine the factors leading to these problems, and to explore some of the coping techniques employed to deal with challenges of ERP system use. To analyse this argument, this research presented a theoretical framework (see Figure 3.1). The theoretical framework proposes the related domains of End User Problem, Antecedent Factors and Coping Mechanisms. As described in Chapter 3, the framework was based on the literature review and the exploratory study for the identification of relevant constructs for both end user problems and coping mechanisms domains. The antecedent factors domain was based on the Task-Technology Fit theory, the Gap Framework and the Computer Self-Efficacy concept (see Section 3.3 for detailed explanation).
The findings analysis reported in Chapter 5 suggests that the three conceptual domains (ERP System Use Problems, Antecedent Factors and Coping Mechanisms) are characterised by a complex interaction and relationships either between and/or within the three. Hence, based on the extant literatures and the findings of this thesis, Figure 6.1 shows the revised conceptual framework called the EUPCOM Model. The EUPCOM Model presents a holistic review of the relevant problems, antecedent factors and coping mechanisms that influence ERP system usage.

In the EUPCOM model, the study provides an improved classification of problem factors by introducing a number of subcategories that emerged under system-related and data-related problems. The system problem is extended to include: (a) system functionality problem (unavailability of function), (b) system usability problem (non-learnability) and (c) system underutilisation. The data incompleteness problem that is part of the data quality factor is...
extended by adding data inaccuracy and untimeliness. In addition, the EUPCOM model captures the complexity of the relationships between each of the problems. The detailed discussion is in Section 6.3.1.

The antecedent factor domain of the initial conceptual model is restructured in the revised EUPCOM Model, which also introduces new subcategories for the antecedent factors. The two constructs in the initial model used to explain organisation antecedent factors – resources and control – were based on the Gap Framework. The resources construct is expanded in the EUPCOM Model to cover the sub-categories of lack of funds, lack of support and lack of training. Therefore this study supports the application of the Gap Framework (Behrens & Seda 2004) as it enhanced the finding that lack of resources in terms of funding and support to provide the necessary training to ERP system users resulted in usability problems and underutilisation of the system. The wider the gap between the antecedent factors (resources) and the requirements of end users, the greater the problems encountered. A detailed description of this phenomenon was given in Section 6.3.2.

The antecedent user factor in the initial conceptual framework (Figure 3.1) was based on two computer self-efficacy dimensions: individual strength and magnitude. The initial framework was revised to eliminate the magnitude dimension due to insufficient evidence from the case studies (Chapter 5). In the revised EUPCOM Model, a new sub-category of lack of awareness has been added.

Both the task and technology antecedent factors of the initial framework were based on the Gap Framework and the Task-Technology Fit theory. According to TTF theory, to realise the positive effect of an individual performance, the technology: (1) must be utilised and (2) it must be a good fit with the tasks it supports (Goodhue & Thompson 1995). If these conditions apply, the result is task-technology fit and subsequent improvement of organisational performance. Technology and task are therefore the two elements that significantly predict TTF. As seen in the revised EUPCOM Model, only technology affordance was found to contribute to the unavailability ERP functions (see Section 6.3.2). Thus, in this study, the unavailability of functions as discovered in both the exploratory and the main study is partly influenced by the technology characteristics of the TTF, in this case, a lack of technology affordance, which forces users to find alternatives to the ERP system.

The revised EUPCOM Model, as well as presenting changes in the end user problems, antecedent factors and coping mechanisms, also demonstrates the links between these three domains, thus providing a theoretical contribution. This is in line with Whetten’s (1989)
suggestion that one way to demonstrate the value of a proposed change in a list factors is to identify how the change affects the relationships between the constructs or variables. The relationships, not the lists, are the domain of theory (Whetten 1989, p. 492).

As stated by TTF, to fully utilise an ERP system, its functionalities should match users’ task requirements. However, the EUPCOM Model does not support TTF in terms of the task-related factor due to only a small amount of evidence found from the three cases. Consequently, the TTF concept is excluded from the revised model (EUPCOM).

## 7.4 CONTRIBUTIONS OF THE THESIS: THEORETICAL AND PRACTICAL

The research makes several theoretical and practical contributions, as discussed in the following section.

### 7.4.1 Contributions to Research and Theory

This study makes several contributions to IS literature, specifically to post-implementation ERP system literature. First, by using an inductive approach, the study has developed an original End User Problem and Coping Mechanisms (EUPCOM) Model. The model provides insight into the impediments of effective use of ERP and integrates the post-implementation ERP issues, the antecedent factors to ERP usage problems and the use of feral systems in coping with the identified ERP issues. Based on Gregor’s (2006) classification, the EUPCOM Model falls under the second subtype of theory for explaining at a lower level. By incorporating and adapting some constructs from the Gap Framework, the Task-Technology Fit theory and the Computer Self-Efficacy concept, the model explains how ERP usage problems occurred. The model can be used to analyse the causal factors between an ERP usage issue and its antecedent factors, in line with the second type of theory proposed by Gregor (2006, p. 264).

Second, based on the EUPCOM Model, the empirical evidence from the present thesis enables the investigator to formulate fourteen (14) research propositions that could be tested, refuted, confirmed or refined by subsequent research. For example, using the quantitative survey could provide a stronger sense of size and strengthen the relationships found between the three main domains of user problems, antecedents and coping mechanisms, as
discussed in detail in Section 6.3. Thus the study provides a sound foundation for future ERP research.

Third, this study contributes to post-implementation ERP system literature not just by identifying and classifying end user problems but also by stressing the complex relationships between the problems, the antecedent factors that lead to usage issues and the coping mechanisms. For example, this study highlights the relationship between usability and underutilisation and between poor interface and usability. The causes of ERP usage problems are also outlined. This relationship is not simply a direct relationship but can also involve complex relationships between the three domains of problems, antecedent factors and coping mechanisms. To the best of the investigator's knowledge, the present effort is among the first to examine the relationship between ERP usage problems and the conceptualisation of ‘feral system’ as a coping mechanism beyond the implementation stage. Other researchers have already studied feral systems, a term coined by Houghton and Kerr (2006). But the studies by other researchers (Kerr & Houghton 2010; Spierings, Kerr & Houghton 2012; Thatte & Grainger 2010) were in the context of an independent concept to explain a technology artefact that an end user employs instead of the mandated information system.

Fourth, this study makes an original contribution to the re-conceptualisation of feral systems in the ERP system literature. This is achieved through the establishment of the ‘feral system’, ‘shadow system’ and ‘workaround’ concepts as coping mechanisms. Although previous work such as that by Ignatiadis and Nandhakumar (2009) examined how workaround could occur (that is, due to user ignorance of system functionality which results in decreasing organisational control), in this thesis, the workaround, feral system and shadow system concepts are merged to represent the two coping strategies of feral information system and feral use of information technology, with feral data as a by-product of the feral use of IT.

Fifth, through investigating the coping mechanisms used by end users, the thesis contributes to the positive role of feral systems in the ERP system literature. Although previous work such as the study by (Ignatiadis & Nandhakumar 2009) identified that workaround could occur because of user ignorance of system functionality, thus decreasing organisational control, this thesis offers a clear distinction between feral information systems and feral use of IT. Coping mechanisms can be treated as positive acts, an apparatus to make users' work more efficient or to compensate for the deficiency of an ERP system. Thus, to the investigator's knowledge, this thesis is the pioneer study that integrates the feral system concept as a coping strategy with the ERP usage issue and its related causal conditions.
7.4.2. Contributions to Practice

From a practical point of view, the outcomes of this thesis contribute in several ways. First, the findings from the thesis suggest data, system, technical and interface issues as the most common ERP-use-related problems. Particularly, data and system are considered as two widely reported issues that need immediate attention from managers. Data is a problematic area when users are unable to get timely, accurate and complete data from the ERP system. Incorrect data leads to incorrect information, which in turn affects the other processes in the organisation.

Similarly, the system problems also need to be handled appropriately since the inability of users to understand and learn a highly integrated system discourages users from continuing to use it even though the usage of the ERP system is mandatory. These problems hinder effective ERP system usage. Managers as well as other practitioners should anticipate possible problems and assess the potential threats to their respective departments. Organisations should institute actions to recognise not only the actual ERP usage problems but also the symptoms that occur at the early phase of implementation that might lead to greater problems in the later phase of post-implementation. For instance, it is important for managers to address the quality of data and information issues as early as possible because the quality of data is one of the major determinants of ERP success and usage.

Second, findings from the case studies also suggest that end users' usage problems are the result of user, organisation, technology and task issues. The identification of the underlying causes of SAP usage problems could become the motivating factor for individual users to undertake reflective feedback and to achieve extended use of the implemented ERP system. For instance, users from the clerical and supervisory levels frequently experience data quality and system usability issues that are mainly caused by their own lack of individual strength, skills and knowledge. Hence, organisations should consider changes in terms of the work context, redesigning job categories or modifying job descriptions in order to attract users to further explore SAP system functionalities.

Third, the results of this thesis indicate that management attention should be directed to equip ERP users with relevant ERP system knowledge. This could be achieved through monitoring ERP system usage problems over time by deploying training strategies and enhancing the available support service. Training in this case is important not only for ERP users to understand how to use the system in their particular area, but also for the managers to appreciate users’ responses to ERP and how they will also influence other users within
and across the organisation. Because the implementation of an ERP system involves considerable changes in organisation-wide technology and business processes, therefore supervisors as well as subordinates must be trained in order to fully utilise the system. For most users, training would be their first experience with an ERP system. Thus, it is desirable that training be designed to improve users’ self-efficacy and to accumulate the necessary knowledge of the business process. Without ongoing training, the value of the integrated system may be underemphasised. An ERP system requires time and practice to master. Time plays a role in the success of ERP training because, given the time and practice after training, end users can strengthen their learning.

Fourth, although user training should not be neglected, the capabilities of ERP systems must be clearly understood and documented. Incomplete understanding of the system capabilities tends to result in underuse and misconceptions of the functionalities of the system. With respect to this, the management must ensure that documents detailing each area of the SAP system functionalities and processes are made available in the respective organisations. In adding to that, the documentation may be worthless if end users cannot see the value it brings to them.

Fifth, only a comprehensive and full usage of the system capabilities will deliver major benefits, acknowledging the fact that users’ behaviour and attitudes toward the ERP system influence the value obtained from an organisation’s ERP system, especially in the long run. Therefore, in order to fully exploit ERP system functionalities, there is an urgency to consider the functionality of the system and the user sophistication. These could be achieved by management by instilling awareness and providing any necessary support to the users. At the same time, users need to move from a superficial use to a more comprehensive use of the ERP system.

Knowing the problems and their antecedent factors is not sufficient to address the various problems that have been identified. This leads to the sixth practical implication of the research: how managers can recognise a coping mechanism such as workaround or use of a feral system. This research could also assist managers to recognise the feral information system and workaround, and how these two types of coping mechanisms might influence the use of the ERP system in a positive or negative manner.
7.5 LIMITATIONS OF THE STUDY AND POSSIBLE FUTURE RESEARCH

Seven limitations of this thesis suggest avenues for further research. These limitations are: (i) not capturing the usage problems of an ERP system across different time spans, (ii) not capturing a multi-user perspective of ERP system use problems, (iii) not capturing any influencing cultural factors, (iv) a possible lack of generalisability of the present findings to contexts other than Malaysia due to a limited case study, (v) validation and testing of the proposed EUPCOM model and research propositions, (vi) not analysing the impact of the ERP system use problems on the organisation, (vii) changing the ERP landscape from product to service (or cloud ERP) and (viii) not capturing different usage behaviours. These limitations are discussed below.

Limitation i: Not capturing the usage problems of an ERP system across different time spans.
This thesis was not specifically designed to capture ERP usage issues and coping mechanism across different time spans. Although companies experience ERP problems at all phases of the ERP system life cycle (Markus et al. 2000), the emphasis of this study is on the usage issue encountered by end users during the post-implementation phase. Having said that, the investigator is mindful of the importance of the early identification and correction of ERP system problems, as proposed by (Markus & Tanis 2000). For future research, a longitudinal study of system use could be carried out to capture the different patterns of ERP usage problems and how the problems evolve over time.

Limitation ii: Not capturing a multi-user perspective of ERP system use problems.
This thesis did not evaluate a multi-user perspective of ERP usage problems. Previous studies have also examined ERP system usage at a multilevel perspective rather than individual level. For instance, in the work by Burton –Jones & Gallivan’s (2007), they advocated a multilevel perspective on system usage that integrates conceptions of system usage at the individual and collective level. They also underlined the need for research on the linkages between levels of analysis and the means by which system usage leads to downstream consequences. However, this approach was not adopted in this thesis because the aim is to examine system usage issues at a single level of analysis (the individual level).
Regardless of the different types of user, this thesis aimed to identify the ERP usage problems and ways users deal with them. Nonetheless, the investigator acknowledges that different types of ERP system users may experience different types of usage issues, given the fact that work context and prior ERP system use are important in predicting and influencing ERP system usage problems. As suggested in previous studies, users are categorised into two types: power user and regular user, based on their functionality and familiarity with information technology (Boudreau & Robey 2005; Lombard, Snyder-Duch & Bracken 2002).

Power users are more likely to encounter a different pattern of problems, and how they cope with ERP usage issues could be different from regular users. The current analysis did not consider these differences, and future studies could look into that. Future research could also, then, extend the End User Problem and Coping Mechanisms Model (EUPCOM) by examining the use of the ERP system in the context of a larger number of end users. In doing so, further work needs to include the multi-user perspective and the behaviour of power users and regular users across a variety of industries in order to validate the results of this study and to derive additional insights.

**Limitation iii:** Not capturing any influencing cultural factors.

The third limitation of this thesis is in terms of limited sample of case studies, which may represent a lack of generalisability of the present findings to other contexts. With three organisations that have unique organisational cultures and their own special characteristics, the results might not be similar in other organisations and another environment. Given the fact that cultural factors are not included in the data analysis for this thesis, it is not possible to establish any cultural impact on the ERP system use problems and how users deal with the encountering issues.

Hence, research could be extended to other organisations outside Malaysia by taking into consideration the different cultural context. A comparison between the studies may contribute to the research findings and support the research strength. According to Collier (1993), the country-specific case studies produced by area specialists are crucial building blocks in most comparative work. Nonetheless, cross-culture comparison would provide insights from different perspectives into the ERP system usage problems, their causal factors and the coping mechanisms. Future research may aim to explain the ways that culture constructs and is constructed by the behaviour and experiences of its members. Perhaps an ethnography study could be done by using multiple data collection methods.
These may range from surveys to observational data, video tapes, photographs and recordings of speech in action.

**Limitation iv:** A possible lack of generalisability of the present findings to contexts other than Malaysia due to a limited case study.

The selected organisations represent two different industries: the oil and gas industry and manufacturing. (Bennett 2004) argued that bias can occur when the number of cases that represent a sample is not large enough to claim that the findings are applicable to the population from which the sample was taken. In addition, one of the most common criticisms of the case study method is that the method is prone to selection bias. This limited number of cases is explained by the fact that accessibility is still a major concern in conducting case study research in Malaysia. Because of the small number of case studies conducted, the findings of this study are not generalisable in the statistical sense, yet the results are generalisable into theory (Lee & Baskerville 2003). Therefore, the case study approach can be applied and extended to examine the ERP usage problems in different types of businesses or industries including commercial and non-profit organisations. Conducting a similar study using a broad and diverse sample to further extend and enhance the thesis findings would not only provide a new perspective on the area of study but it might also help to promote better understanding of ERP usage issues and their impacts in different organisations and environments.

**Limitation v:** Validation and testing of the proposed EUPCOM model and research propositions.

With respect to this limitation, the End User Problems and Coping Mechanisms (EUPCOM) Model that was derived from a limited number of case studies is an avenue for future research. More research is needed to test and validate not only the proposed EUPCOM Model but also the research propositions. For instance, quantitative research may be conducted to measure and analyse the causal relationships between the three research domains of problems, antecedents and coping mechanisms. Longitudinal qualitative research could also be carried out for deeper investigation and validation of the relationships identified in the current study.

**Limitation vi:** Not analysing the impact of the ERP system use problems on the organisation.

The research was not intended to explore the impact of ERP usage problems on organisations, either in a positive or negative manner. The thesis is focused on establishing the relationships between the problems and their antecedent factors and how users are
managing them by employing various coping mechanisms. It would be interesting to look at the impact of ERP usage problems so that the necessary action could be taken to minimise the negative impacts.

**Limitation vii:** Changing the ERP landscape from product to service (or cloud ERP).

This thesis has adopted the traditional view of an ERP system as a product. However, the ERP landscape is now changing towards ERP as a service (or cloud ERP). The identification of some of the problems as well as their antecedents and the coping mechanism factors may be irrelevant to that new environment to a certain extent. For instance, in the cloud ERP environment, security and interoperability issues deserve substantial attention from the ERP implementing organisation (Dillon, Chen & Chang 2010). This is in comparison to the findings from the present thesis that system quality and data quality are the two most significant ERP system issues.

**Limitation viii:** Not capturing different usage behaviours.

This study was not intended to capture different usage behaviours. For instance, Li, Hsieh & Rai (2013) have identified two post-acceptance information system (IS) usage behaviours related to how employees leverage implemented systems. Routine use (RTN) refers to employees’ using IS in a routine and standardised manner to support their work, and innovative use (INV) describes employees’ discovering new ways to use IS to support their work.’ However because the thesis focuses on problems and coping mechanisms we did not explore different usage behaviours.

### 7.6 CONCLUDING REMARKS

An ERP system embodies the largest, most complex and demanding information system implemented by organisations and is a major departure from the individual and departmental information systems prevalent in the past. Organisations and individuals are extensively affected, and many problematic issues remain to be researched. The latest development of the emerging trend of cloud computing gathers weight with new and improved ERP systems. The biggest advantages offered by cloud ERP systems are low cost of ownership, little up-front cost for the ERP software and no additional hardware cost. Because of its nature, cloud ERP can be remotely accessed.
Hence, some of the problems faced by end users of traditional ERP systems could be resolved by a Cloud ERP environment. For instance, one of the issues highlighted in this research is the problems with technical infrastructure such as server and networking capacity. With the implementation of Cloud ERP, an organisation would be able to minimise the infrastructure cost because there is no cost involved in purchasing the hardware or software as the infrastructure is rented in the cloud environment, thus making the capital investment nil. However, some of the usage issues found in a traditional ERP system could worsen in Cloud ERP system interoperability due to the difficulty in integrating cloud services with an organisation’s own existing legacy systems, which is the current practice of the traditional ERP system environment.

Migrating to Cloud ERP requires careful consideration but it is a way forward for any businesses that wish to increase their business sophistication with the most cost-efficient method.
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Appendix 3.1: Phase 1 - An Exploratory Study - Interview Questions (Managers)

RMIT University

College of Business

School of Business Information Technology

1. What is your job title? How long have you been working in the company?
2. What are your managerial scopes of activities?
3. What major information systems and technologies are used in your department?
4(a) Could you tell me your experience in the SAP system use (management purposes)?
   (b) How long have you department used the SAP systems?
5. Are there any problems, challenges and issues you encountered while managing the SAP system use by you employee?
6. Does your department use its own “locally” developed information systems?
7. If so what was the need to create and use these systems? Who developed it? Why? Who uses it? For what purpose? How much is it supported by the IT department?
8. Are all the information systems that are in use in your department/division supported by the central IT department?
9. Are your division’s business requirements incorporated in the scope of SAP?
10. How do you support those requirements that are not supported by the SAP?
11. How has SAP affected the level of control of how certain operations relating directly to your division were performed?
12. What do you do in order to get better control of your operations?
13. What additional feature has been added to SAP since its first Implementation? How did that upgrade affect your departments’ work?
14. What were the major upgrades/ extensions that your division has asked for since the implementation of SAP?
15. How long does it normally take to get these added functionalities programmed into the SAP system?
16. How did you conduct the business processes that required the “added ” functionality before the upgrade
17. Has there been a case where your department work has been affected because users in other departments didn’t use the SAP system?

18.(a) What are the inconveniences encountered while managing the system/ data created by your employee?

(b) Are systems created follows the procedures specified by the management?

(c) How do the systems/ data that you have created comply with the standard and policies in the organization?
Appendix 3.2: Phase 1 - An Exploratory Study - Interview Questions
(End Users)

RMIT University

College of Business

School of Business Information Technology

1. What is your job title? How long have you been working in the company?
2. What are the scopes of your activities?
3. What kind of technologies and systems do you use in your work?
4. What are the functionalities of these systems?
5. Who developed these systems, for what purpose, which uses them, who maintains them, how long have they been in use?
6. How do these systems interface to SAP to keep it updated with the latest information?
7(a) Could you tell me your experience in the SAP system use?
(b) How long have you used the SAP systems?
8(a) Are you currently heavy or light user of SAP system?
(b) How does your computer experience and skills influence your ability to use the SAP system?
9. Are there any problems, challenges and issues you encountered while using the SAP system?
10. How do you overcome those problems/challenges/issues?
11(a) Why do you create that? Could you give me an example?
(b) How has it helped you?
(c) Does your boss aware of this initiative? (If No)
(d) What would happen if they find out?
(e) In what way is this initiative is supported by your boss?
12(a) Who else supported this initiative?
(b) Does the IT department aware of this initiative?
(c) What are their reactions?
(d) Do you get help from IT department to build the system?
Appendix 3.3: Phase 1 - An Exploratory Study - Exploratory Survey Questionnaires

RMIT University
College of Business
School of Business Information Technology

All information and responses in this form will be used only for the Academic purposes. Your response will be kept in strict confidence. The result of the survey will be reported in summary forms only, no individual company information will be revealed.

A. Demographics of the Respondents.
1. What is your job title? (Select one)
   
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<tbody>
<tr>
<td>a.</td>
<td>Director, Manager</td>
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<td>b.</td>
<td>Executives</td>
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<tr>
<td>c.</td>
<td>Administrator</td>
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<tr>
<td>d.</td>
<td>Supervisor</td>
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<td>e.</td>
<td>Clerk</td>
</tr>
<tr>
<td>f.</td>
<td>Other</td>
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2. How long have you been working in the company?
   
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<tr>
<td>a.</td>
<td>&lt; 3 years</td>
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<td>b.</td>
<td>3-5 years</td>
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<tr>
<td>c.</td>
<td>6-10 years</td>
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<tr>
<td>d.</td>
<td>&gt; 10 years</td>
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<tr>
<td>e.</td>
<td>&gt; 20 years</td>
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3. How long have you been using SAP system?
   
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<tbody>
<tr>
<td>a.</td>
<td>&lt; 3 years</td>
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<td>b.</td>
<td>3-5 years</td>
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<td>c.</td>
<td>6-10 years</td>
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<td>d.</td>
<td>&gt; 10 years</td>
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<td>e.</td>
<td>&gt; 20 years</td>
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</table>
B. Rating of the Post ERP (SAP) implementation issues and its alternative solution.

Please circle the following issue based on how strongly you believe they influenced your ERP (SAP) **system** use. Please note that if the problems significantly contributed to the development/creation of the alternative systems. The factors could be rated within the ranges of “Strongly Disagree” (1) to “Strongly Agree” (4)

Some of the below are in your list so make sure not to duplicate

<table>
<thead>
<tr>
<th>No</th>
<th>Questions</th>
<th>The Post Implementation Issues of SAP system use</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>1</td>
<td>SAP is not effective in providing a method for <strong>accessing</strong> data relevant to my job requirements</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>The SAP system difficulties force me to create/use the other alternatives (system/process).</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>I regularly pull data out of SAP and put it into either Access databases or Excel.</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>I regularly update the data I keep in Access database or Excel.</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>I rely heavily on a manual record that I created outside the SAP environment.</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>SAP is not effective in providing a method for <strong>manipulating</strong> data relevant to my job requirements.</td>
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<tr>
<td>7</td>
<td>The data I pull out of SAP is always accurate and very reliable.</td>
<td>1</td>
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<tr>
<td>8</td>
<td>The SAP implementation has slowed the time taken to complete my work.</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>I use excel/access or other information systems and/or technology in order to overcome the deficiencies of the SAP system.</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>The SAP system implementation has slowed the time taken to complete my work.</td>
<td>1</td>
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<tr>
<td>11</td>
<td>Our department had an information system that provides information and functionality which meet the needs of the department better than SAP.</td>
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<td></td>
<td>Description</td>
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<td>12.</td>
<td>SAP is not effective in <strong>generating a report</strong> to management.</td>
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<tr>
<td>13.</td>
<td>I rely heavily on a record created by others which is outside the SAP environment.</td>
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<td>14.</td>
<td>In my department we use other systems which are not interfaced with the SAP.</td>
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<tr>
<td>15.</td>
<td>SAP does not completely support my department’s business processes.</td>
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<tr>
<td>16.</td>
<td>Because other departments do not always use SAP, it is affecting my work.</td>
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<tr>
<td>17.</td>
<td>The implementation of SAP has completely eliminated the use/development of departmental/end-user specific systems.</td>
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<tr>
<td>18.</td>
<td>SAP doesn’t provide me control over my own work and work processes.</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Our department/work unit uses a system whose functionality are similar in many ways to SAP.</td>
<td></td>
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<tr>
<td>20.</td>
<td>Our department/work unit uses a system in order to overcome the limitations of SAP.</td>
<td></td>
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<tr>
<td>21.</td>
<td>I use excel/ access or other information systems and technology even if it duplicates the functionality of SAP.</td>
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Appendix 3.4: Phase 1 - An Exploratory Study - Consent Forms

RMIT HUMAN RESEARCH ETHICS COMMITTEE

Prescribed Consent Form for Persons Participating In Research Projects Involving Interviews, Questionnaires, Focus Groups or Disclosure of Personal Information

<table>
<thead>
<tr>
<th>College OF</th>
<th>Business</th>
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<td>SCHOOL/CENTRE OF</td>
<td>Business Information Technology</td>
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</tbody>
</table>

Name of Participant:

**Project Title:** Living With ERP: An Investigation of End User Problems and Coping Mechanisms

<table>
<thead>
<tr>
<th>Name(s) of Investigators:</th>
<th>Phone:</th>
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<tbody>
<tr>
<td>(1) Sharina Binti Tajul Urus</td>
<td>+613 99251471</td>
</tr>
<tr>
<td>(2) Associate Professor Alemayehu Molla, PhD</td>
<td>+613 9925 5803</td>
</tr>
<tr>
<td>(3) Say Yen Teoh, PhD</td>
<td>+613 99255788</td>
</tr>
</tbody>
</table>

1. I have received a statement explaining the interview/questionnaire involved in this project.

2. I consent to participate in the above project, the particulars of which - including details of the interviews or questionnaires - have been explained to me.

3. I authorize the investigator or his or her assistant to interview me or administer a questionnaire.

4. I give my permission to be audio taped: ☐ Yes ☐ No

5. I give my permission for my name or identity to be used: ☐ Yes ☐ No

6. I acknowledge that:

   (a) Having read the Plain Language Statement, I agree to the general purpose, methods and demands of the study.

   (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.

   (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.

   If I participate in a focus group I understand that whilst all participants will be asked to keep the conversation confidential, the researcher cannot guarantee that other participants will do this.

   (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_____________(researcher to specify). Any information which may be used to identify me will not be used unless I have given my permission (see point 5).
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 Chair, Portfolio Human Research Ethics Sub-Committee, Business Portfolio, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 5594 or email address rdu@rmit.edu.au. Details of the complaints procedure are available from: http://www.rmit.edu.au/rd/hrec_complaints
Appendix 3.5 : Phase 1 - An Exploratory Study - Plain Language Statement

Form

RMIT University
College of Business
School of Business Information Technology

Research Title: Living With ERP: An Investigation of End User Problems and Coping Mechanisms

A research project conducted by:

Sharina Binti Tajul Urus, PhD (Business Information system) candidate,
School of Business Information Technology, RMIT University, Building 108, Level 17, Bourke St,
GPO Box 2476V, Melbourne VIC 3001,
Australia.
Telephone: +613 99251471
E-mail: sharina.tajulurus@rmit.edu.au /

Associate Prof Alemayehu Molla, Associate Professor of Business Information Systems
School of Business Information Technology, RMIT University, 239 Bourke Street,
Melbourne, VIC 3000,
Australia
Telephone: +613 99255803
E-mail: alemayehu.molla@rmit.edu.au

Dr. Say Yen Teoh
School of Business Information Technology, RMIT University, 239 Bourke Street,
Melbourne, VIC 3000,
Australia
Telephone: +613 99255788
E-mail: sayyen.teoh@rmit.edu.au

Dear Participant

You are invited to participate in a research project being conducted by RMIT University. This information sheet describes the project in straightforward language, or ‘plain English’. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please ask one of the investigators.

This research is being conducted by Ms Sharina Tajul Urus, a PhD Student at the School of Business Information Technology, RMIT University. The research project is being conducted under the supervision of Associate Professor Alemayehu Molla and Dr. Say Yen Teoh. The research project has been approved by the RMIT Business College Human Research Ethics Sub committee. The research is fully funded by a government scholarship from Malaysia. Petronas’s management has allowed for this study to be conducted in Petronas and you are now being approached to participate in this study.
The main aim of this study is to examine users’ experience in using Enterprise Resource Planning (ERP), also known as SAP, system, the challenges that users are facing in their interaction with ERP (SAP) and the mechanisms that they adopt to overcome those challenges. Therefore, the main research question would be ‘Why do post ERP problems exist and what are their impacts on ERP system use?’

The research will be conducted through a series of interviews with key people and end user in your organization. A total of seven (7) participants are expected to participate in an individual interview. You are being invited to participate in the interview because you are directly involved in the ERP system use in PETRONAS.

Your responses to the interview questions will be kept strictly confidential and available only to the researcher and her supervisors. If you agree to participate, you will sign a consent form prior to the interview. The interview will take about one hour. With your permission, the interview will be tape-recorded to ensure the accuracy of the data collected. During the research period, the tape and all written material will be stored in a locked filing drawer in the School of Business Information Technology, RMIT University, Melbourne, Australia. Only the researcher and supervisors will have access to this data.

In line with RMIT’S Human Research Ethics Committee guidelines, the data (audio-tape and interview notes) will be retained for 5 years upon completion of the project after which time paper records will be shredded and placed in a security recycle bin and electronic data will be deleted/destroyed in a secure manner. The data collected will be analysed and results may be published in academic journals and conferences without including information that can potentially identify either you or your organization, unless you give us a written permission to do otherwise.

There are no foreseen risks associated with your participation in this research project. The benefits of participating in this research may be the opportunity this would create for you to reflect back on your ERP (SAP) system usage and share your insight about any problem you encounter while using the system. In addition, your participation in the research might yield some suggestion to better manage the post ERP problems. Any information that you provide can be disclosed only if (1) it is to protect you or others from harm, (2) a court order is produced, or (3) you provide the researchers with written permission.

Your participation in this research is voluntary. As a participant, you have the right to withdraw your participation at any time; have any unprocessed data withdrawn and destroyed, provided it can be reliably identified, and provided that so doing does not increase your risk; and have any questions answered at any time.

Any complaints about your participation in this project may be directed to the Secretary, College of Business Human Research Ethics Sub Committee, Business College, RMIT University, GPO Box 2476V, Melbourne, 3001. The telephone number is (613) 9925 5594 or email address edu@rmit.edu.au. Details of the complaints procedure are available from the above address or via the internet at http://www.rmit.edu.au/council/hrec

If you have any questions regarding this research, please contact either the researcher or one of his supervisors at the address above.

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If you agree to participate, please complete the enclosed informed consent form and return it to the investigator below.

Yours Sincerely

Sharina Tajul Urus  
PhD Research Student  
School of Business Information Technology  
RMIT University  
Tel: +613 99251471  
E-mail: sharina.tajulurus@rmit.edu.au
Appendix 3.6: Phase 1 - An Exploratory Survey - Plain Language Statement Form

RMIT University
College of Business
School of Business Information Technology

Research Title: Living With ERP: An Investigation of End User Problems and Coping Mechanisms

A research project conducted by:

Sharina Binti Tajul Urus, PhD (Business Information system) candidate, School of Business Information Technology, RMIT University, Building 108, Level 17, Bourke St, GPO Box 2476V, Melbourne VIC 3001, Australia.
Telephone: +613 99251471
E-mail: sharina.tajulus@rmit.edu.au

Associate Prof Alemayehu Molla, Associate Professor of Business Information Systems School of Business Information Technology, RMIT University, 239 Bourke Street, Melbourne, VIC 3000, Australia
Telephone: +613 99255803
E-mail: alemayehu.molla@rmit.edu.au

Dr. Say Yen Teoh
School of Business Information Technology, RMIT University, 239 Bourke Street, Melbourne, VIC 3000, Australia
Telephone: +613 99255788
E-mail: sayyen.teoh@rmit.edu.au

Dear Participant

You are invited to participate in a research project being conducted by RMIT University. This information sheet describes the project in straightforward language, or ‘plain English’. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please ask one of the investigators.
This research is being conducted by Ms Sharina Tajul Urus, a PhD Student at the School of Business Information Technology, RMIT University. The research project is being conducted under the supervision of Associate Professor Alemayehu Molla and Dr. Say Yen Teoh. The research project has been approved by the RMIT Business College Human Research Ethics Sub committee. The research is fully funded by a government scholarship from Malaysia. Petronas’s management has allowed for this study to be conducted in Petronas and you are now being approached to participate in this study.

The main aim of this study is to examine users’ experience in using Enterprise Resource Planning (ERP), also known as SAP, system, the challenges that they are facing in their interaction with ERP (SAP) and the mechanisms that they adopt to overcome those challenges. Therefore, the main research question would be ‘Why do the post ERP problems exist and what are their impacts on ERP system use?’

The research will be conducted through a survey with the ERP (SAP) system users in Petronas. About 100 respondents are expected to take part in this survey. The respondents are from the various departments in the Petronas including Human Resource, Supply Chain Management, Operational Performance Improvement, Finance & Planning, Plant Operations, Engineering Services, Technical Services, Health, Safety, & Environment. You are being invited to participate in the survey because you are directly involved in the ERP system use in PETRONAS. The survey will take about 15-20 minutes to be completed. The survey will be distributed by the researcher at the site. A package containing the survey questionnaires and the Plain Language Statement will be given to you during the field study. You will be required to complete paper survey. The completed survey form will be collected by the researcher at the end of her visit at PASB.

Your responses to the survey questions will be kept strictly confidential and available only to the researcher and her supervisors. Due to the nature of this data collection, we are not obtaining written informed consent from you. Instead, we assume that you have given consent by your completion and return of the questionnaire. During the research period, the survey response will be stored in a locked filing drawer in the School of Business Information Technology, RMIT University, Melbourne, Australia. In line with RMIT’S Human Research Ethics Committee guidelines, the data (the survey response) will be retained for 5 years upon completion of the project after which time paper records will be shredded and placed in a security recycle bin and electronic data will be deleted/destroyed in a secure manner. The data collected will be analysed and results may be published in academic journals and conferences without including information that can potentially identify either you or your organization, unless you give us a written permission to do otherwise.

There are no foreseen risks associated with your participation in this research project. The benefits of participating in this research may be the opportunity this would create for you to reflect back on your ERP (SAP) system usage and share your insight about any problem you encounter while using the system. In addition, your participation in the research might yield some suggestion to better manage the post ERP problems. Any information that you provide can be disclosed only if (1) it is to protect you or others from harm, (2) a court order is produced, or (3) you provide the researchers with written permission.

Your participation in this research is voluntary. As a participant, you have the right to withdraw your participation at any time; have any unprocessed data withdrawn and destroyed, provided it can be reliably identified, and provided that so doing does not increase
your risk; and have any questions answered at any time.

Any complaints about your participation in this project may be directed to the Secretary, College of Business Human Research Ethics Sub Committee, Business College, RMIT University, GPO Box 2476V, Melbourne, 3001. The telephone number is (613) 9925 5594 or email address rdu@rmit.edu.au. Details of the complaints procedure are available from the above address or via the internet at http://www.rmit.edu.au/council/hrec

If you have any questions regarding this research, please contact either the researcher or one of his supervisors at the address above.

If you agree to participate, please complete the enclosed informed consent form and return it to the investigator below.

Yours Sincerely

Sharina Tajul Urus  
PhD Research Student  
School of Business Information Technology  
RMIT University  
Tel: +613 99251471  
E-mail: sharina.tajulurus@rmit.edu.au
Appendix 4.1: Phase 2 - Main Study - Interview Questions (Managers)

RMIT University
College of Business
School of Business Information Technology

SECTION A: Demographics of the Respondents
- What is your job title?
- How long have you been working in the company?
- What are the managerial scopes of your activities?

SAP System use

1) Could you tell me about the computer systems skills and trainings that you have?
2) Could you tell me your experience in using the SAP system?
- How do you rate your confidence level?
3) How long have your department used the SAP systems?
4) Are there any problems, challenges and issues encountered by you or the staff that you supervise in using SAP system?
- What is your expectation from the SAP system?
- How SAP system is able to fulfill those expectations?
5) If you are facing some difficulties in using SAP system, where do you go to get support?
6) Are your division’s business requirements incorporated in the scope of SAP?
7) How has SAP affected the level of control of how certain operations relating directly to your division were performed?
8) What do you do in order to get better control of your operations?
9) How do you support those requirements that are not supported by the SAP?
10) What were the major upgrades/ extensions that your division has asked for since the implementation of SAP?
11) How long does it normally take to get these added functionalities programmed into the SAP system?
12) How did you conduct the business processes that require the “added” functionality
before the upgrade?

**SECTION B: Manifestation of ‘Feral system’**

13) Has your department ever used or is using other information systems that are not integrated with SAP system?

14) What are the functionalities of this system? In what way is this system supported by your department?

15) Who developed these systems (for what purpose, who uses the system, who maintains them, how long have they been in use)?
   - To what extent do your subordinates use the alternatives systems?
   - How does these alternatives eases their work or to help them?

16) Can you describe your involvement with these systems?

17) For those systems you have described and characterized earlier (the alternatives systems) as well as your personal involvement with them, could you explain why they are there?
   - What aspects of the task-related issues influence you or your subordinates to use the alternative system? (complexity, simplicity of the task)
   - What aspects of the user’s issues influence you to use or your subordinates to use the alternative system?
   - What aspect of the technologies issues influence you or your subordinates to use the alternative system?
   - What aspect of the organisations’ issues influence you or your subordinates to use the alternative system?

18) How different is this initiative (system) from the SAP systems? Different in what way? Could you give us some examples?

19) Are systems /data created follows the procedures specified by the management?

20) How do the systems/ data that you have created comply with the standard and policies in the organisation?
Appendix 4.2: Phase 2 - Main Study - Interview Questions (IT Managers)

RMIT University
College of Business
School of Business Information Technology

SECTION A: Demographics of the Respondents
- What is your job title?
- How long have you been working in the company?
- What are the scopes of your activities?

SAP System use

1) Could you tell me your experience in coordinating the SAP system use in the various departments/divisions?
   - In term of your confidence level?
   - In term of your computer skills?
2) How long have your department coordinating the SAP system used in your organisation?
3) Are there any problems, challenges and issues encountered by you in coordinating the SAP system use by the employee?
   - What is your expectation from the SAP system implementation?
   - How SAP system is able to fulfill those expectations?
4) What support do you provide to the user while using the SAP system?
   - In term of your expertise?
   - In term of the training?
   - In term of the resources?

SECTION B: Manifestation of ‘Feral system’

5) Does your department aware on the existence of the “locally” developed systems?
   - How are these systems being created?
6) What are your reactions on these locally developed systems?
7) Who developed these systems, for what purpose, which uses them, who maintains
them, how long have them been in use?
- Do you provide help for the department to build the system?
- To what extent they are using the alternatives systems?
- How do these alternatives ease their work or help them?

8) What would be the factors lead them to use these alternatives systems?
- Factors related to users issues?
- Factors related to task issues?
- Factors related to technologies issues?
- Factors related to organisation issue?

9) How different is this initiative (system) from the SAP systems? Different in what way? Could you give us some examples?

10) If it is similar (to SAP system), in what way? Could you give us some examples?

11) Are systems /data created follows the procedures specified by the management?

12) How do the systems/ data that you have created comply with the standard and policies in the organisation?
Appendix 4.3: Phase 2 - Main Study - Interview Questions (End Users)

RMIT University

College of Business

School of Business Information Technology

SECTION A: Demographics of the Respondents

- What is your job title?
- How long have you been working in the company?
- What are the scopes of your activities?

SAP System use

1) Could you tell me your experience in the SAP system use?
   - In term of your confidence level?
   - In term of your computer skills?
2) Are you currently heavy or light user of SAP system?
3) How does your computer experience and skills influence your ability to use the SAP system?
4) Are there any problems, challenges and issues you encountered while using the SAP system?
   - What is your expectation from the SAP system implementation?
   - How is SAP able to fulfill those expectations?
5) How do you overcome those problems/challenges/issues?
6) If you are facing some difficulties in using SAP system, where do you get the support?

SECTION B: Manifestation of ‘Feral system’

7) (a) What kind of technologies and systems do you use in your work? Could you give me an example?
    (b) How is this system being created?
8) What are the functionalities of these systems?
9) Who developed these systems, for what purpose, which uses them, who maintains them, how long have them been in use?
   • To what extent have you used the alternatives systems?
   • How these alternatives do eases your work or helps you?
10) How do these systems interface to SAP to keep it updated with the latest information?
11) Can you describe your involvement with these systems?
12) For those systems you have described and characterized earlier (the alternatives systems) as well as your personal involvement with them, could you explain why they are there?
   • What aspects of the task issues influence you to use the alternative system? (complexity, simplicity of the task)?
   • What aspects of the user’s issues influence you to use the alternative system?
   • What aspect of the technologies issues influence you or your subordinates to use the alternative system?
   • What aspect of the organisations’ issues influence you to use the alternative system?
13) How different is this initiative (system) from the SAP systems? Different in what way? Could you give us some examples?
14) If it is similar (to SAP system), in what way? Could you give us some examples?
15) Are systems /data created follows the procedures specified by the management?
16) How do the systems/ data that you have created comply with the standard and policies in the organization?
17) (a) Is your boss aware of this initiative? (If No)
   (b) What would happen if they find out?
   (c) In what way is this initiative is supported by your boss?
18) (a) Who else supported this initiative?
   (b) Is the IT department aware of this initiative?
   (c) What are their reactions?
   (d) Do you get help from IT department to build the system?
Appendix 4.4: Phase 2 - Main Study - Consent Forms

RMIT BUSINESS COLLEGE HUMAN ETHICS ADVISORY NETWORK

Prescribed Consent Form for Persons Participating In Research Projects Involving Interviews, Questionnaires, Focus Groups or Disclosure of Personal Information

<table>
<thead>
<tr>
<th>COLLEGE OF</th>
<th>Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHOOL/CENTRE OF</td>
<td>Business Information Technology and Logistics</td>
</tr>
<tr>
<td>Name of Participant:</td>
<td></td>
</tr>
<tr>
<td>Project Title:</td>
<td>Living With ERP: An Investigation of End User Problems and Coping Mechanisms</td>
</tr>
<tr>
<td>Name(s) of Investigators:</td>
<td>(1) Sharina Binti Tajul Urus Phone: +613 99251471</td>
</tr>
<tr>
<td></td>
<td>(2) Associate Professor Alemayehu Molla, PhD Phone: +613 9925 5803</td>
</tr>
<tr>
<td></td>
<td>(3) Say Yen Teoh, PhD Phone: +613 99255788</td>
</tr>
</tbody>
</table>

1. I have received a statement explaining the interview/questionnaire involved in this project.
2. I consent to participate in the above project, the particulars of which - including details of the interviews or questionnaires - have been explained to me.
6. I authorise the investigator or his or her assistant to interview me or administer a questionnaire.
7. I give my permission to be audio taped: ☐ Yes ☐ No
8. I give my permission for my name or identity to be used: ☐ Yes ☐ No
6. I acknowledge that:

(f) Having read the Plain Language Statement, I agree to the general purpose, methods and demands of the study.
(g) I have been informed that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied.
(h) The project is for the purpose of research and/or teaching. It may not be of direct benefit to me.
(i) 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.

If I participate in a focus group I understand that whilst all participants will be asked to keep the conversation confidential, the researcher cannot guarantee that other participants will do this.

(j) 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___________(researcher to specify). Any information which may be used to identify me will not be used unless I have given my permission (see point 5).
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 Chair, Business College Human Ethics Advisory Network, College of Business, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 5598 or email address rdu@rmit.edu.au. Details of the complaints procedure are available from http://www.rmit.edu.au/browse;ID=2jqrmb7hpyo
Appendix 4.5: Phase 2 - Main Study - Plain Language Statement

RMIT University
College of Business
School of Business Information Technology and Logistics

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT
PROJECT INFORMATION STATEMENT

Project Title: Living With ERP: An Investigation of End User Problems and Coping Mechanisms

Investigators:
Sharina Binti Tajul Urus, PhD (Business Information System) candidate, School of Business Information Technology and Logistics, RMIT University, Building 108, Level 17, Bourke St, GPO Box 2476V, Melbourne VIC 3001, Australia.
Telephone: +613 99251471
Fax +613 9925 5850
E-mail: sharina.tajulurus@rmit.edu.au

Associate Prof Alemayehu Molla,
School of Business Information Technology and Logistics, RMIT University, 239 Bourke Street, Melbourne, VIC 3000, Australia
Telephone: +613 99255803
Fax +613 9925 5850
E-mail: alemayehu.molla@rmit.edu.au

Dr. Say Yen Teoh
School of Business Information Technology and Logistics, RMIT University, 239 Bourke Street, Melbourne, VIC 3000, Australia
Telephone: +613 99255788
Fax +613 9925 5850
E-mail: sayyen.teoh@rmit.edu.au

Dear Participant

You are invited to participate in a research project being conducted by RMIT University. This information sheet describes the project in straightforward language, or ‘plain English’. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please ask one of the investigators.

This research is being conducted by Ms Sharina Tajul Urus, a PhD Student at the School of Business Information Technology and Logistics, RMIT University. The research project is being conducted under the supervision of Associate Professor Alemayehu Molla and Dr. Say Yen Teoh. The research project has been approved by the RMIT Business College Human Research Ethics Sub committee.
The research is fully funded by a government scholarship from Malaysia. The management of your organisation has allowed for this study to be conducted and you are now being approached to participate in this study.

The main aim of this study is to examine users’ experience in using Enterprise Resource Planning (ERP), also known as System Application and Products (SAP), the challenges that they are facing in their interaction with ERP (SAP) and the mechanisms and systems that they create and adopt to overcome those challenges. The research will be conducted through a series of interviews with key people and end users in your organisation. The interview will be scheduled for approximately 1 to 2 hours per each session. Questions will be designed using the conceptual framework. Interviews will be open-ended in nature with the question expanding on emerging themes will be asked as required. All the interviews will be audio taped. The permission to be taped will be sought from the interviewee in the interview sessions. The participants have the right to request that the taping cease at any stage during the interview. All information gathered during the course of this research, including your responses will be securely stored for a period of 5 years in the School of Business Information Technology, RMIT University, and can only be accessed by the researchers. After 5 years the data will be destroyed. Results published in academic journals and conferences will not include information that can potentially identify either you or your organisation.

There are no foreseen risks associated with your participation in this research project. The benefits of participating in this research may be the opportunity this would create for you to reflect back on your ERP (SAP) system usage and share your insight about any problem you encounter while using the system. In addition, your participation in the research might yield some suggestion to better manage the post ERP problems. You may elect to receive a summary of the results of the study. In order to receive this summary, you need to provide us with a contact address during the session. Addresses collected in such a manner will only be used for disseminating the results and will be destroyed afterwards. Due to the nature of the data collection process, we are obtaining written informed consent from you. Please read this consent form carefully and be confident that you understand its contents before signing the consent form. If you have any questions about the project please feel free to contact one of the investigators. A copy of signed consent form will be given to you for your records.

Your participation in this research is voluntary. As a participant, you have the right to withdraw your participation at any time; have any unprocessed data withdrawn and destroyed, provided that it can be reliably identified and provided that so doing does not increase your risk; and have any questions answered at any time. Any information that you provide can be disclosed only if (1) it is to protect you or others from harm, (2) a court order is produced, or (3) you provide the researchers with written permission. If you have any questions regarding this research, please contact either the researcher or one of his supervisors at the address above. If you agree to participate, please complete the enclosed informed consent form above and return it to the investigator.

Yours Sincerely,

Sharina Tajul Urus
(PhD research candidate)
RMIT University

Alemayehu Molla PhD
(Research Primary Supervisor/ Associate Professor)
RMIT University

Say Yen Teoh PhD
(Research Second Supervisor/ Lecturer)
RMIT University
Appendix 4.6: Ethics Approval for an Exploratory Study

Dear Sharina,

I am pleased to advise that your application for ethics approval for a Research Project has been approved by the Chair of the Business College Human Ethics Advisory Network. Approval has been granted for the period from 10 June 2009 to 21 July 2012.

The RMIT Human Research Ethics Committee (HREC) requires the submission of Annual and Final reports. These reports should be forwarded to the Business College Human Ethics Advisory Network Secretary. Annual Reports are due in December for applications submitted prior to September the year concerned. I have enclosed a copy of the Annual/Final report form for your convenience. Please note that this form also incorporates a request for extension of approval, if required.

Best wishes for your research.

Yours sincerely

Prue Lamont
Secretary
Business College Human Ethics Advisory Network

End.
Appendix 4.7: Ethics Approval for Main Study

Ref: Ethics Appl. 1000116

Tuesday, February 23 2010

Miss Sharina Tajul Urus
School of Business Information Technology & Logistics
College of Business
RMIT University

Dear Sharina

I am pleased to advise that your application for ethics approval for a Research Project has been approved by the Chair of the Business College Human Ethics Advisory Network. Approval has been granted for the period from 23 February 2010 to 21 July 2012.

The RMIT Human Research Ethics Committee (HREC) requires the submission of Annual and Final reports. These reports should be forwarded to the Business College Human Ethics Advisory Network Secretary. Annual Reports are due in December for applications submitted prior to September the year concerned. I have enclosed a copy of the Annual/ Final report form for your convenience. Please note that this form also incorporates a request for extension of approval, if required.

Best wishes for your research.

Yours sincerely

Kristina Tsoulis-Reay
Secretary
Business College Human Ethics Advisory Network

Encl.
Appendix 4.8: Permission Letter (Case A)

17 February 2010

PETRONAS AMMONIA SDN BHD (654245-A)
Ms Sharina Tajul Urus
PhD Student
School of Business IT and Logistics
RMIT University, Building 108, level 17
239 Bourke Street
Melbourne VIC 3000

Dear Sharina,

Thank you for your letter outlining your proposed study: The Post-ERP Feral System Investigation of Causes and Manifestations. PETRONAS Ammonia Sdn Bhd is looking forward to work with you in achieving the outcomes of the study.

The following outlines our understanding of the scope of the PETRONAS Ammonia Sdn Bhd involvement in the study.

1. The research will focus on the context of the users' experience in using Enterprise Resource Planning (ERP), also known as System Application and Products (SAP), the challenges that they are facing in their interaction with ERP (SAP) and the mechanisms and systems that they create and adopt to overcome these challenges.

2. Participants from both managerial and end user will be involved in the interview session. The participants are from five main departments; Technical services, Plants/Operations, Engineering Services, Human Resource Department and Finance and Planning Department.

3. The interview session will be conducted at the PETRONAS Ammonia Sdn Bhd office located in Kerteh, Terengganu, Malaysia

4. The permission is also given to access the various documents such as policies, procedures, guideline, report pertaining to SAP use in PASB. The document will also include the communication such as email, letter, memo and other related documents.

5. CONFIDENTIALITY
   5.1 Ms Sharina shall undertake to keep strictly confidential the various documents such as policies, procedures, guideline, report pertaining to SAP use in PASB. Ms Sharina shall not, either during or after the completion of this research, divulge or utilise any confidential information belonging to PASB which may have come to her knowledge during this research and after the completion of this research, take all reasonable precautions to keep all such information secret.

   5.2 All such information, as well as the conclusions on findings of the work during, and in connection with this research shall exclusively be the property of PASB. Ms Sharina shall not without the consent of PASB retain or make originals or copies of policies, procedures, guideline, report pertaining to SAP use in PASB.

   5.3 Ms Sharina shall not either orally or in writing or in any form make any public statement, comment or any matters relating to the procedures, guideline, report pertaining to SAP use in PASB.
Appendix 4.9: Permission Letter (Case B)

Letter of Support from Ingress Corporation Berhad

17 February 2010

Ms Sharina Tajul Urus
PhD Student
School of Business IT and Logistics
RMIT University, Building 108, level 17
239 Bourke Street
Melbourne VIC 3000

Dear Sharina,

Thank you for your letter outlining your proposed study: The Post-ERP Feral System Investigation of Causes and Manifestation. Ingress Corporation Berhad is looking forward to work with you in achieving the outcomes of the study.

The following outlines our understanding of the scope of the Ingress Corporation Berhad involvement in the study.

1. The research will focus on the context of the users’ experience in using Enterprise Resource Planning (ERP), also known as System Application and Products (SAP), the challenges that they are facing in their interaction with ERP (SAP) and the mechanisms and systems that they create and adopt to overcome those challenges.

2. Participants from both managerial and end user will be involved in the interview session. The participants are from various departments included Finance, Management Information System Division, Production/Operation.

3. The interview session will be conducted at Ingress Corporation Berhad office located in Ampang, Selangor, Malaysia and it related subsidiaries.

4. The permission is also given to access some non-confidential documents such as policies, procedures, guideline, report pertaining to SAP use in Ingress Corporation Berhad. The document will also include the communication such as email, letter, memo and other related documents.

Ingress Corporation Berhad welcomes the opportunity this research project to look at the post implementation issues of SAP system use in our organisation.

Yours Sincerely,

HILMI BIN HAMDAN
General Manager
Group Human Resource Management
Ingress Corporation Berhad

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APPENDIX 5.1: MIS ORGANISATION CHART OF CASE B