Virtual Teamwork and Human Factors: A Study in the Cross-national Environment

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

This is to certify that except where due acknowledgement has been made,

I. The work is that of the author alone.

II. The work has not been submitted previously, in whole or in part, to qualify for any other academic award.

III. The content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program.

IV. Ethics procedures and guidelines have been followed.

Yu-Min Chou

Date:
Abstract

There has been considerable research on technical aspects of virtual teams, such as the use of collaborative technologies and computer mediated communication. By contrast, little research has focused on the human aspects of virtual teams such as the way team members cooperate in the context of cross-national boundaries. This study addresses this gap in the literature by exploring key human factors that may influence virtual teams working in the cross-national environment. It intends to answer the two central research questions. 1) What are the main human factors affecting the virtual teamwork in the cross-national environment? 2) Do those human factors have the influential effects? Why or why not? The study applies the Hackman and Morris’s (1975) inputs-processes-outputs (I-P-O) model and discusses relevant theories, such as Bundura’s social cognitive theory, Nonaka’s socialisation, externalisation, combination and internalisation (SECI) knowledge transfer model and Fishbein and Ajzen’s theory of reasoned action (TRA), to build the research framework that identifies a number of important human factors affecting virtual teamwork, including individual competencies, knowledge sharing willingness and behaviour, member’s satisfaction, communication, trust, and leadership. By using the triangulation mixed method, combining both quantitative and qualitative approaches, this study comprehensively discusses research findings to construct a model of multinational virtual teamwork. Research findings can help to fill the gap in academic research and also provide practice applications in business companies.
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List of abbreviations

CMC  Computer mediated communication
CO   Individual cultural openness
CQ   Individual cultural intelligence
CTs  Collaborative technologies
EQ   Emotional intelligence
GSS  Group support system
ICTs Information and communication technologies
I-P-O model Input-processes-outputs model
IQ   Intelligence quotient
KMO  Kaiser-Meyer-Olkin measure of sampling adequacy
KSB  Knowledge sharing behaviour
KSW  Knowledge sharing willingness
MNCs Multinational corporations
MS   Member’s satisfaction
MSLQ Motivated strategies for leaning questionnaires
PDOMM Perceived the dissimilarity openness moderator
SE   Self-efficacy
SECI Socialisation, externalisation, combination and internalisation
SEM  Structure equation modelling
SMM  Shared Mental Model
TRA  Theory of reasoned action
VTs  Virtual teams
Chapter 1: Introduction

The international business environment has been changing dramatically as a result of globalisation and the emergence of a knowledge-based workforce. With advanced information technology, it has been possible for work teams to operate across national boundaries. These work teams, referred to here as virtual teams have become an increasing characteristic of the operation of modern corporations. Many multinational corporations (MNCs) utilise virtual teams to achieve operational efficiency because these teams, using computer-based communication systems, can allow distant and time dispersed employees to combine their knowledge and skill without the expense of travel. Working in the context of a cross-national environment is a common characteristic of a virtual team, so investigating virtual teamwork in cross-national settings should be emphasised in academic research. This study applies a concurrent mixed-research method to develop an understanding of how virtual teams work in the context of cross-national boundaries by converging both quantitative and qualitative data. The first chapter introduces the background to the study with the existing literature, explains the research questions, methodology, significance, and definition of terms in order to provide an overview of this research into virtual teams.

1.1 Background to the Study

Teamwork is widely utilised in organisations to achieve high levels of performance in business operations since people cooperating together can complete a job with better quality than an individual working alone (Marks et al., 2001). The growth of a global marketplace and a more knowledge-based workforce has led to the creation of this new style of teamwork for overcoming the limitations of distance and time through
the use of computer-based communication systems (Potter and Balthazard, 2002, Piccoli et al., 2004b). Increasingly, a new organisational form, a virtual team, has been utilised by major multinational companies (Lipnack and Stamps, 1997, Maznevski and Chudoba, 2000) to achieve operational efficiency (Lipnack and Stamps, 2000) and improve strategic performance (Geister et al., 2006). As such, virtual teams have emerged as an important new area in both industry and academic research (Powell et al., 2004, Lewis et al., 2005).

Research into teams in organisations has largely concentrated on the human factors of the teams/workgroups (Ayoko and Härtel, 2006, Fujimoto and Härtel, 2004, Fujimoto et al., 2005, Rice and Rice, 2005, Rynes et al., 2001). This research has examined self-efficacy (Stone and Bailey, 2007, Van Mierlo et al., 2006), cultural openness (Fujimoto and Härtel, 2004), cultural intelligence (Earley, 2002), and knowledge sharing behaviour (Rice and Rice, 2005, Zárraga-Oberty and Saá-Pérez, 2006), to seek an understanding of their influence on team performance (Watson and Michaelsen, 1988, Lent et al., 2006, Judge et al., 2007). By contrast, much of the research into virtual teams has emphasised the technical and technological aspects of virtual teams (Rice et al., 2000, Maurer and Holz, 2002, Ahn et al., 2005, Curşeu et al., 2008), rather than the human factors of virtual communities/teams (Chiu et al., 2006, Staples and Webster, 2007).

The majority of discussions of virtual teams’ knowledge sharing has tended to deal with how communication technology is used (Griffith et al., 2003, Malhotra and Majchrzak, 2004, Paul, 2006) or the ability of telecommunications to disseminate information across large distances or diverse locations (Roberts, 2000) rather than the quality and nature of the knowledge sharing that occurs in virtual working.
environments. There have been some few smaller studies that identified the significance of the relationship between knowledge sharing by virtual team members and performance (Ardichvili et al., 2003, Chiu et al., 2006).

In addition to knowledge sharing behaviour, there is some research on the human factors in the work of virtual teams that deals with the differences in collaboration style between virtual teams and conventional teams (Gibson and Cohen, 2003, Maznevski and Chudoba, 2000), trust (Brown et al., 2004), team empowerment (Kirkman et al., 2004), conflict management (Paul et al., 2004) and communication effectiveness (Andres, 2006) in virtual environments. In the literature review, a number of small studies on self-efficacy in virtual communities/teams were identified (Chiu et al., 2006, Staples and Webster, 2007). However, previous studies have rarely dealt with a team member’s individual attitude and abilities to work in a cross-national environment, such as cultural openness or cultural intelligence, in virtual teams; however, a cross-national working environment is an important area of academic research as virtual teams are widely used in many MNCs (Lipnack and Stamps, 2000), and global virtual teams are frequently replacing traditional co-located teams (Edwards and Sridhar, 2005). How virtual team members interact with each other in the context of cross-national boundaries is, therefore, a crucial issue to research.

1.2 Research Questions and Framework

The purpose of this research is to understand how virtual teams work in the cross-national environment by exploring selected human factors that may influence virtual team cooperation. In particular, it intends to answer two central research questions:
1. What are the main human factors affecting virtual teamwork in the cross-national environment?

2. Do those human factors have influential effects? Why or why not?

The study will propose a new model of virtual teamwork in a cross-national environment. Figure 1.1 shows the theoretical framework on which this research is constructed based on Nonaka’s knowledge transfer SECI model, Fishbein and Ajzen’s theory of reasoned action (TRA), Bundura’s social cognitive theory, and individual cross-cultural competencies, to fill the literature gap and provide practical applications to industry.
Figure 1.1: Structure of the Study

Research Background & Environment

Early 1980’s
Conventional Team research
Focus on various areas, including human aspects.

(1) Globalisation
(2) Advance of Technology

Late 1990’s
Virtual Team research
Focus on technological and technical aspects mainly.

Literature Gap
Human aspects of virtual teamwork
(1) Cultural issues
(2) Self-efficacy
(3) Knowledge sharing

Theoretical Framework
(1) Hackman and Morris’s I-P-O model
(2) Individual cultural intelligence and openness
(3) Bandura’s social cognitive theory
(4) Nonaka’s SECI model
(5) Fishbein and Ajzen’s theory of reasoned action (TRA)

Research Outcome and Findings

Theoretical and Practical Contribution
Previous research into virtual teams has frequently utilised Hackman and Morris’s (1975) inputs-processes-outputs (I-P-O) model to explore an integrated framework of teamwork (Gaudes et al., 2007). Applying the I-P-O model is considered as an appropriate basis in this study to construct a new model of virtual teamwork in a cross-national environment. The literature review revealed that, while research has emphasised the significance of individual cultural intelligence, individual cultural openness, self-efficacy, and knowledge sharing in investigating the I-P-O model, this has been in terms of conventional teamwork, and those human factors have been rarely discussed in terms of virtual teams. To fill the gap in the existing research, this study will develop a cross-national virtual team framework based on the I-P-O model and investigate the influences of individual cultural intelligence and openness, self-efficacy, and knowledge sharing within a team.

An individual’s culture, as represented by the values and outlook which individuals bring from their nationality and education, is an important factor which can affect virtual teamwork because a virtual team member’s attitude towards social interaction within a team is significantly impacted by his or her own personal cultural values and individual competencies in dealing with cultural difference within a team (Maznevski and Chudoba, 2000). Cultural intelligence and cultural openness are emphasised as important individual competencies. Cultural intelligence is defined as ‘the capability of an individual to function effectively in situations characterised by cultural diversity’ (Ang and Van Dyne, 2008a, p.3), and cultural openness is defined more broadly as ‘a person’s interest in and experience with foreign people, values, and cultures’ (Strizhakova et al., 2008a, p.60). Ang and Van Dyne (2008a) demonstrated that cultural intelligence can positively affect an individual’s attitude to collaboration in a team. Fujimoto et al. (2005) showed that cultural openness/openness to perceived
dissimilarity can obviously moderate the influence of diversity in group processes. Thus, individual cultural intelligence and openness are considered two human factors associated with individual competencies in the research investigation.

Self-efficacy can be regarded as another human factor relating to individual competencies that influences virtual team cooperation. Self-efficacy, the core theory of Bandura’s social cognitive theory, emphasises that the belief in one’s personal ability can seriously affect the individual’s behaviour and performance because self-evaluation can regulate individual reactions (Bandura, 1986). This theory can be applied in investigating virtual working environment as some previous research has utilised it to discuss knowledge transfer in a virtual team or community (Chiu et al., 2006, Staples and Webster, 2007). People are more willing to face challenges and take positive action if they believe they have enough ability to produce desirable outcomes (Bandura, 1986). Therefore, investigating the impact of self-efficacy on virtual teamwork is significant because self-efficacy can affect personal attitudes and actions in the virtual team environment.

Nonaka and Takeuchi’s socialisation, externalisation, combination and internalisation (SECI) model has been widely used in research on organisations, groups and conventional teams (Nonaka, 1994, Rynes et al., 2001, Rice and Rice, 2005, Zárraga-Oberty and Saá-Pérez, 2006). By contrast, the SECI model has only rarely been applied in virtual organisations (Curşeu et al., 2008). According to Nonaka (2007), humans, rather than mechanical processes, mainly facilitate knowledge sharing and transferring because knowledge exists in human minds and begins by one individual sharing. Knowledge creation is the combination of ‘tacit’ and ‘explicit’ knowledge and a continuous cycle including four basic processes, socialisation,
externalisation, combination, and internalisation (Nonaka and Konno, 1998). Given the nature of virtual teams, it is arguably not possible to investigate socialisation, which in the model requires face-to-face contact, to such teams. Moreover, combination, which is highly related with information technology (e.g., database design and transaction memory systems), is not an issue of human factors. Consequently, both externalisation and internalisation are focused on in the research to investigate knowledge sharing behaviour within a virtual team.

Fishbein and Ajzen’s Theory of Reasoned Action (TRA) proposes a relationship between attitude, intention and behaviour, and it assumes that performance of a specific behaviour is determined by a person’s intention to perform the behaviour and their attitude toward the behaviour (Fishbein and Ajzen, 1975). In social psychology, TRA has been widely utilised to explain behavioural intentions and actual behaviour (Bock and Kim, 2002). For example, Bock and Kim (2002, p.15) argue that ‘TRA can be a useful model for explaining the knowledge sharing in organisations’. Such studies (Bock and Kim, 2002, Lin, 2007) have examined and affirmed the relationships of Fishbein and Ajzen’s theory of reasoned action (TRA) in the knowledge-sharing context. Thus, this study assumes that TRA can be applied to the virtual setting, and utilises attitude toward knowledge sharing and intention to share knowledge to investigate individual knowledge sharing willingness in a virtual team.

As mentioned, this research concentrates on the investigation of several human factors, including individual cultural intelligence, individual cultural openness, self-efficacy, and knowledge sharing within a team, to develop a model of cross-national virtual teamwork. Investigating the relationships between those human factors by quantitative approach could partly answer the research question of what human
factors affect virtual teamwork in the cross-national environment. However, a quantitative method will not explore the causality between the factors that affect virtual teamwork.

This research aims at building a virtual teamwork model that can work in the context of cross-national boundaries. Applying a qualitative approach is significant because it can answer how and why (and why not) individual cultural intelligence and openness, self-efficacy, and knowledge sharing have their effect, and it can also help to explore other potential factors that can influence virtual team cooperation. Consequently, there are two areas of focus in the research investigation in order to achieve a better understanding of multinational virtual teamwork. One research aim is to examine the relationships between observed human factors proposed by the literature review. The second aim is to explore what other factors may affect virtual teamwork in a cross-national environment, and why those other factors have potential influences on virtual team cooperation.

1.3 Research Methodology

This study utilises a concurrent mixed research method to obtain general knowledge about virtual teamwork in a cross-national environment. The ontological position in this research is that reality is a concrete structure, or, at least, the result of concrete processes. This positions the researcher’s epistemological stance as objectivism and the theoretical perspective is post-positivism. Post-positivism assumes the theory is revisable and doubts the researcher’s ability to know reality with certainty (Phillips and Burbules, 2000). The importance of multiple measures is emphasised because all measurements and observations are fallible and may possess different types of error (Creswell, 2003). Both quantitative and qualitative data are important to provide a
comprehensive analysis of the virtual teamwork model. The rationale for these positions will be discussed more extensively in Chapter 4.

The quasi-experimental method, using quantitative strategy, is extremely useful in investigating the influence of individual cultural intelligence, individual cultural openness, self-efficacy, and knowledge sharing within a work team as it allows the researcher to control team composition by assigning team members based on their individual competencies, locations and nationalities in the study. The method of controlling different variables in a virtual team for observing how human factors influence teamwork is emphasised in this study. Thus, applying quasi-experimental design is more valuable than traditional surveys for quantitative data collection. A quasi-experiment is a scientific research method primarily used in the social sciences as the random assignment of subjects is sometimes impossible or impractical in the research design. According to Karayza and Keating (2007, p.2597), if there is ‘non-practicability of locating a large number of voluntarily participating units who would be randomly assigned to groups’, quasi-experimental design can be suggested as an appropriate method. Many researchers, especially those who studying in knowledge management and virtual environments, select participants from university students (Alge et al., 2003, Sarker et al., 2005, Chen et al., 2008, Liu et al., 2008a). This study follows that example by conducting team experiments using university students. Research samples are drawn from Master’s level students studying in different countries, including Australia, Indonesia, Taiwan, and Vietnam, because assigning virtual team members from different countries is necessary to ensure that virtual teams work in the context of cross-national boundaries. More details of quasi-experimental design with surveys will be discussed in Chapter 4.
In qualitative research, five strategies are commonly used: ethnographies, grounded theory, case study, phenomenological research, and narrative research (Creswell, 2003). The case study is an appropriate method for this study because cases are usually bounded by time and activity, and allow collection of detailed information about individuals who are associated with a particular activity (that is the experimental activity in this research). Case studies can provide a better understanding of the interaction of individuals in work teams through in-depth exploration. As mentioned earlier, the research sample is drawn from four different countries due to the consideration of a multi-national setting. Team members’ experiences of working in different countries that have dissimilar national telecommunication infrastructure is a focus of this virtual team research so the first level of case selection was choosing those four countries. The second level of sampling was to choose whether an individual participated in the experimental project or not. From each country, one individual who participated in the virtual team activity and another individual who did not participate were drawn as a single unit of analysis, so interviews are conducted with two people in each case selection. The researcher travelled overseas to conduct face-to-face interviews so eight individuals were interviewed in four different countries. The case study design will be explained in more detail in Chapter 4.

1.4 Significance of Study

There are a number of scholars who concentrate on the human factors of conventional teams, including cultural intelligence, cultural openness and self-efficacy as well as knowledge sharing. Little research has emphasised the human factors of virtual teams, however, the technical and technological aspects of virtual teams have drawn researchers’ attention. Although some studies have investigated the willingness and
barriers for sharing knowledge in virtual working environments (Ardichvili et al., 2003, Papacharalambous and McCalman, 2004b), there is a lack of literature which discusses knowledge sharing processes at the individual level. Nonaka’s SECI model is well-known and extensively utilised to investigate knowledge sharing processes in research on traditional organisations (Shull et al., 2004) but it is rarely applied in virtual organisations (Curşeu et al., 2008). The externalisation and internalisation processes of Nonaka’s SECI model are used to investigate in virtual team work settings in order to improve the knowledge of virtual teamwork. In addition, there is little research on the influence of individual competence for dealing with cultural diversity in virtual teams even though the cross-national working environment is a vital influential factor to team performance in most of the studies (Pnina, 2008). In this study, the focus on cross-national virtual teamwork is emphasised and the impact of individual competence in overcoming national background difference is investigated to understand how team members interact and collaborate within a cross-national virtual team.

By investigating the effects of human factors on virtual teamwork, this research can contribute to both academic research and industry. To enhance the completeness of virtual team research, several theoretical concepts are discussed in this study which are rarely investigated in the virtual team setting in order to propose a conceptual model of teamwork in the context of cross-national boundaries. These include cultural intelligence and openness, self-efficacy, Nonaka’s SECI model, and theory of reasoned action (TRA), are discussed in this study in order to propose a conceptual model of teamwork in the context of cross-national boundaries. This research can provide a new model of virtual teamwork in the cross-national environment that is distinct from previous studies. Also, other potential factors affecting teamwork could
be found by the discussion of a new model and those new findings could enhance our understanding of how teams cooperate in virtual team working environments. For practical application in business organisations, this study can help industry to improve the creative ability of virtual teams by understanding how human factors influence teamwork. For example, interpersonal knowledge sharing behaviour in a team could be a critical factor which affects virtual team effectiveness. Many MNCs, such as Shell Oil, General Electric, and Sun Microsystems, operate business activities by using global virtual teams (Lipnack and Stamps, 1997, Lipnack and Stamps, 2000); however, there is the lack of research that discusses the impact of cross-cultural competence on virtual knowledge sharing, especially at an individual level. Investigating the relationship among individual competence, knowledge sharing, and virtual team performance, can help industries to understand and manage cross-national virtual teams, especially in the selection, training, development, and performance management of virtual team members.

1.5 Structure of the Thesis
This first chapter has provided an overview of the research. It has introduced the research background in order to clarify the study purpose and central research questions. Research issues and aims were also developed by justifying the main concerns in the study. After illustrating the research objective, the methodology was simply described and justifications of the study were presented. Based on these foundations, this research will be explored in more depth.

In Chapter 2, the relevant literature is discussed in order to establish the theoretical framework for the research. By applying the I-P-O model, a virtual team framework that works in a cross-national environment, is constructed by the investigation of
human factors at the individual level. Cultural intelligence and openness, self-efficacy of social cognitive theory, Nonaka’s knowledge transfer SECI model, and theory of reasoned action, are reviewed to fill the gap in human factors discussion in the existing research. Research hypotheses that investigate the influences of those observed human factors on the cross-national virtual teamwork are developed.

The review of Chapter 3 provides a comprehensive understanding of cross-national virtual teamwork by discussing other potential factors that could affect team cooperation. Examining the role played by individual cultural intelligence, individual cultural openness, and self-efficacy in facilitating knowledge sharing in virtual teams in not enough to build a virtual team model. Communication, trust, and leadership are proposed as moderators affecting the relationships in the processes of virtual teamwork, which inform the development of the virtual team framework.

The next three chapters examine collected data by testing research hypotheses and discussing interview data. Chapter 4 explains the research methodology and why the mixed method, both quantitative and qualitative approaches, has been applied in the investigation of this virtual team study. Quantitative approach, using quasi-experimental design and qualitative approach, using case study design, are described in detail. In Chapter 5, descriptive data for the research questions and the results of testing research hypotheses are presented. Chapter 6 presents the qualitative analysis to explain the quantitative results. Different sources of evidence, such as data from interviews and observations, are analysed to provide a comprehensive understanding of the research.

Chapter 7 discusses the results of the analysis of both quantitative and qualitative data.
and explains why there are some different findings between this research and the existing literature. Three main arguments, virtual working environment, observation of teamwork processes, and investigation in a multi-national setting, are discussed to explain new findings that do not agree with previous studies in order to build a new model of virtual teamwork in this research. The final chapter identifies the contributions and implications of this study. Research limitations and suggestions for future studies are also discussed. Figure 1.2 below demonstrates the structure of this thesis.

**Figure 1.2: Structure of the Thesis**

![Diagram of thesis structure](image_url)

1.6 **Definition of Research Key Terminologies**

This section provides definitions and descriptions of key terms used in the research to clarify the aims of the study and avoid confusion in ambiguous concepts of those terms.
In this study, the term virtual team means a workgroup cooperating in the virtual environment without face-to-face meetings. The operational definition of virtual team in the thesis is a team comprised of two or more individuals working together from different locations, especially different countries, and where team members communicate by utilising information technology in order to complete a particular goal, that developed based on the research of Cordery and Soo (2008), Gaudes et al. (2007), and Geister et al. (2006).

The term individual cultural intelligence is defined as an individual’s ability, comprising knowledge and skill, that helps them to act and react effectively to cope with cultural differences (Ang et al., 2007, Thomas, 2006).

Along with this definition, the term individual cultural openness refers to an individual’s attitude and willingness to connect with unfamiliar cultures thereby helping them to be open and interact with people from diverse cultures more actively (Fujimoto et al., 2004, Sharma et al., 1994, Strizhakova et al., 2008b, Wenger, 1999).

Self-efficacy is an individual belief about one’s own ability to perform actions, and it is only a judgment but not a real skill (Bandura, 1986). The operational definition of self-efficacy in the thesis is an individual’s belief of their ability to produce good task performance in a cross-national virtual team, and it implies an individual competence for overcoming their cultural difference, that developed based on the research of Neck et al. (1999), Judge et al. (2007) and Lent et al. (2006).

The term knowledge sharing behaviour is the process where team members change
tacit personal knowledge into group knowledge, then, they can also enhance their knowledge through collective action taken from group experiences (Papacharalambous and McCalman, 2004b). Knowledge sharing behaviour, as defined in this virtual team study, includes 1) Externalisation, tacit individual knowledge is translated into comprehensive forms that can be easily understood by other team members (Nonaka and Konno, 1998), and 2) Internalisation, people obtain new knowledge into their own tacit knowledge by absorbing translated knowledge within a team (Nonaka and Konno, 1998).

Knowledge sharing willingness refers to individual concepts, including value, sentiment, opinion, and stereotype, about sharing one’s own personal knowledge with others in a team. It contains the two elements of attitude and intention to share knowledge. Attitude toward knowledge is defined ‘the degree of one’s positive feeling about sharing one’s knowledge’ (Bock and Kim, 2002, p.16), while intention to share knowledge is defined as ‘the degree to which one believes that one will engage in a knowledge sharing act’ (Bock and Kim, 2002, p.16).

The study defines member’s satisfaction as one’s individual satisfaction level with the cooperation between team members, including outcomes and processes of cooperation (Smith et al., 1995). Satisfaction with the outcomes of cooperation is defined as the individual’s satisfaction level with the team performance, such as task outcome and quality, while satisfaction with process of cooperation is defined as the individual’s satisfaction level with the relationship between team members in the cooperation process (Gladstein, 1984).

This study uses the term individual competencies to describe individual cultural
intelligence, individual cultural openness, and self-efficacy together, and utilises the
term observed/investigated human factors to describe individual competencies with
knowledge sharing willingness and behaviour together.
Chapter 2: Developing Human Factors Investigation in Virtual Teams

2.1 Introduction

This chapter aims to address the research gap in existing studies, that is, the impacts of human factors on virtual teamwork that have not been investigated comprehensively. By reviewing relevant studies, this study presents a number of important human factors to help develop the research hypotheses to investigate the central research question of what human factors can affect virtual team cooperation in the cross-national environment. The chapter begins with the concept of the virtual team in this study. A definition of the virtual team is given and the importance of investigating human factors in virtual teamwork is justified by discussing the research gap between conventional and virtual teams.

This chapter then reviews existing research into the virtual team input-process-output (I-P-O) model to provide an understanding of what important human factors have not been adequately discussed in previous virtual team studies. The impacts of individual cultural intelligence, individual cultural openness, and self-efficacy on a virtual team’s knowledge sharing and member satisfaction are stated and a simple virtual team I-P-O model for the research investigation is proposed. Following the simple I-P-O model, there are three independent sections that demonstrate the effects of human factors in different stages of virtual teamwork. The reminder of this chapter will deal with key issues including individual competencies, a virtual team’s knowledge sharing, and member satisfaction, to develop the research hypotheses.
2.2 Virtual Team in Current Studies

2.2.1 Definition of Virtual Team

In this study, the concept of a virtual team is a work group cooperating in the virtual environment through the use of computer-based communication. This virtual team definition is developed on the basis that, unlike conventional teams where a group of people work together (Larson and LaFasto, 1989, Quick, 1992, Shonk, 1982) within a single workplace, the virtual team cooperates across space and time by using communication technology (Lipnack and Stamps, 1997, Arnison and Miller, 2002, Johnson et al., 2002). Two characteristics that are emphasised in the definition are geographically dispersed team members and the use of information communication technology. First, members in a virtual team are usually more than two people who are from different geographical locations and who have to work together across the limitations of distance and different time zones (Cordery and Soo, 2008). This characteristic also implies that virtual team members have diverse national backgrounds. Second, using electronic communication technologies is essential to overcome the geographical boundaries for virtual team cooperation. Virtual team members, interacting from separate locations, must rely on information and communication technologies to collaborate efficiently (Gaudes et al., 2007, Peters and Manz, 2007).

In addition to the two characteristics above, the common goal should also be considered because many scholars have indicated that it is a crucial factor that drives virtual team working. Lahenius and Järvenpää (2004, p.174) stated that ‘a virtual team is a team that shares a common purpose’. Geister et al., (2006, pp.459-460) mentioned ‘virtual teams are defined as two or more persons who work together on a mutual goal or work assignment’ and Hakonen and Lipponen (2008, p.164) defined a virtual team
as ‘a group of people striving toward a common goal’. Consequently, this research defines a virtual team as one that is based on the three characteristics of dispersed team members, technology uses, and a common goal.

In the thesis, the operational definition of a virtual team is that a team comprised of two or more individuals who work together from different locations, especially different countries, and team members who communicate by utilising information technology in order to complete a particular goal. Besides, self-managed virtual teamwork is especially emphasised in the study as self-managed teamwork can be seen commonly in the virtual working environment (Carte et al., 2006). The characteristic of self-direct work teams is that team members take responsibilities and share leadership in the process of teamwork (O’Connell et al., 2002). As virtual team members are separated by different time zone and locations, it is suggested team members to share and rotate the leadership role because the performance is a collective effect among members (Carte et al., 2006). Therefore, this research concentrates on examining virtual teamwork in self-managed working environment.

2.2.2 Focus on Human Factors

A significant research issue in conventional team studies is knowledge management. Some scholars stated that a Shared Mental Model (SMM), which is an organised understanding of knowledge shared within a team, can certainly affect team performance (Banks and Millward, 2007, Klimoski and Mohammed, 1994, Mohammed and Dumville, 2001). Ryan and O’Connor (2009) also proved that team tacit knowledge is a significant factor in influencing team effectiveness in software development teams. Social interaction is an incentive in encouraging team members to share their knowledge. For example, Ramandadham et al. (2009) investigated staff
teams in institutions, schools and afterschool childcare programs, and found that both extra-team and intra-team connections are positively related to knowledge transfer and result in improved team performance. Human aspects, such as social interaction (Zárraga-Oberty and Bonache, 2005) and trust (Rico et al., 2008), are frequently discussed in a team’s knowledge sharing. Moreover, other human aspects of teams, including cultural intelligence (Earley, 2002), cultural openness (Fujimoto and Härtel, 2004), self-efficacy (Van Mierlo et al., 2006, Stone and Bailey, 2007) and their influence on team performance, have been widely discussed.

However, the majority of research into the knowledge management of virtual teams is the use of information technology or computer-based communication tools. Roberts (2000) explored how employing information and communication technologies (ICTs) could improve knowledge transfer because ICTs can help to codify and reduce data and, therefore, support the transfer of knowledge. Rice et al. (2000) also examined the use of collaborative technologies (CTs) for knowledge sharing and knowledge re-use in virtual teams, although the result shows that the use of CTs is insufficient to explain the behaviour of the team. In addition, Malhotra and Majchrzak (2004) proposed that information technology support could overcome the barriers of knowledge sharing in far-flung teams because IT supports task coordination, external connectivity, distributed cognition, and interactivity in telecommunicating teams. Moreover, Paul (2006) examined the significance of collaborative activities in telemedicine projects and stated that the use of ICTs has an obvious influence on knowledge creation in virtual settings. Furthermore, Pnina (2008) investigated the use of ICTs in global virtual teams and proved that the use of ICTs can mitigate the negative effect of cultural diversity and positively impact on decision-making. Meanwhile, Curseu et al. (2008) also considered that the communication process is an important factor
affecting a virtual team’s effectiveness and proposed a systematic
information-processing model for virtual teamwork.

From the discussions above, much of the research into virtual teams has emphasised
the technical aspects of virtual teams, and the majority of discussion of knowledge
sharing has tended to deal with how communication technology is used (Griffith et al.,
2003, Malhotra and Majchrzak, 2004, Paul, 2006) rather than the quality and nature of
the knowledge sharing that occurs in virtual team environments. By contrast, research
into conventional teams/organisations has largely concentrated on the human factors
of knowledge sharing in teams (Rice and Rice, 2005, Zárraga-Oberty and Saá-Pérez,
2006). In fact, codification/cognitive model and personalisation/community model are
regarded as two streams for the management of knowledge work (Hansen et al., 1999,
Swan et al., 1999). Information and communication technology is emphasised as
having a critical role in the first stream because knowledge can be organised as a
quantifiable asset using ICTs (Hansen et al., 1999). Yet, the second stream is more
focused on human factors because knowledge is also created by socially construct
(Swan et al., 1999). Developing networks to link people and encourage knowledge
sharing through social interactions are stressed in this stream (Hansen et al., 1999,
Swan et al., 1999). Although much of the virtual team research discusses information
technology factors, there is still a lack of research into the human factors of virtual
teams. As a result, this study argues that the human factors of virtual teams should be
investigated since many researchers have highlighted the importance of social
relationships in knowledge management (Blackler, 1995, Boland and Tenkasi, 1995,
2.3 Virtual Team’s Inputs-Processes-Outputs (I-P-O) Model

Previous research into virtual teams, especially studies of virtual team effectiveness, commonly utilised the Hackman and Morris (1975) inputs-processes-outputs (I-P-O) model to investigate an integrated framework of virtual teamwork (Gaudes et al., 2007). According to Gaudes et al (2007, pp.84-85), a team’s inputs refer to the initial contributions, such as team design and construction; the processes stage of teamwork explains the continuing interaction between members; and outputs are the consequences of a group’s collaboration, which can relate to either task or non-task items. In the past decade, the I-P-O model is frequently used in virtual team research because important factors that affect team effectiveness can be easily found by viewing three stages of teamwork (Driskell et al., 2003, Piccoli et al., 2004a, Powell et al., 2004 ). By discussing a virtual team’s I-P-O stages, researchers have found many factors/indicators that can influence virtual team effectiveness, which are shown in Table 2.1.

Table 2.1 shows that several indicators have been frequently investigated in research into the virtual team I-P-O model. Indicators most frequently used at the inputs stage are, the nature of task, group characteristics, and technology, as well as organisational system have been widely discussed. While four indicators, communication, coordination, trust and cohesiveness, are commonly examined in processes stage, and two items, team performance and satisfaction, are often used to measure a team’s outcome at the outputs stage.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Indicators</th>
</tr>
</thead>
</table>
| Maznevski and Chudoba (2000)      | - Technology  
- Organisational environment  
- Task  
- Group characteristics  
- Media choice  
- Instrumental uses  
- Attitudes towards use |
|                                   | - Negotiate  
- Execute  
- Communicate  
- Participate |
|                                   | - Quality  
- Commitment  
- Cohesion  
- Individual satisfaction |
| Suchan and Hayzak (2001)          | - Mission  
- Strategy  
- Organisational systems  
- Attitudes toward technology |
|                                   | - Member interaction  
- Communication mindset  
- Mentoring  
- Trust |
|                                   | - Task completion |
| Driskell et al. (2003)            | - Computer mediated communications |
|                                   | - Cohesiveness  
- Status processes  
- Counter-normative behaviour  
- Communication |
|                                   | - Team performance |
| Martins et al. (2004)             | - Group size  
- Knowledge, skill and abilities  
- Technology use  
- Task  
- Group composition |
|                                   | - Mission analysis  
- Goal setting  
- Strategy formulation  
- Communication  
- Participation  
- Coordination  
- Monitoring  
- Conflict  
- Tone of interaction  
- Trust  
- Cohesion  
- Affect  
- Integration |
|                                   | - Affective outcomes  
- Performance outcomes |
| Piccoli et al. (2004a)            | - Team control structure |
|                                   | - Coordination  
- Communication |
|                                   | - Performance  
- Satisfaction |
| Powell et al. (2004 )             | - Design of virtual team  
- Cultural differences  
- Technical expertise  
- Training |
|                                   | - Relationship building  
- Cohesion  
- Trust  
- Communication  
- Coordination  
- Task-technology-structure fit |
|                                   | - Performance  
- Satisfaction |
| Ortiz de Guinea et al. (2005)     | - Group characteristics  
- Nature of task  
- Organisational context  
- Supervisory behaviours |
|                                   | - Expressive and instrumental interactions |
|                                   | - Performance outcomes  
- Attitudinal outcomes  
- Behavioural outcomes |
| Cordery and Soo (2008)            | - Geographic separation  
- Electronic dependence  
- Structural dynamism  
- National diversity |
|                                   | - Transactive memory  
- Work engagement  
- Collective efficacy |
|                                   | - Productive output  
- Integrative group processes  
- Member affective well-being |
As described, some human factors have been discussed in the virtual team I-P-O model previously; however, several important human factors, such as cross-national collaboration and knowledge sharing between members, are lacking investigation. As virtual teams are widely used in many MNCs (Lipnack and Stamps, 2000), global virtual teams are replacing traditional co-located teams (Edwards and Sridhar, 2005). Cross-national virtual teams can easily create new ideas which enhance innovation and creativity by collecting different views from team members (Zakaria et al., 2004), whereas the diversity of individual members’ backgrounds may easily cause confusion between team members and negatively influence understanding (Hunsaker and Hunsaker, 2008). How a cross-national working environment influences virtual team interaction and performance is, therefore, clearly an important issue to research. Moreover, in previous virtual team research, many researchers focused on communication effectiveness, team empowerment, trust, and conflict management (Brown et al., 2004, Kirkman et al., 2004, Paul et al., 2004, Andres, 2006) in team interaction; nevertheless, a crucial issue, knowledge sharing, is little discussed. Knowledge sharing should be emphasised in virtual team studies because knowledge can spread quickly and widely via telecommunication media (Griffith et al., 2003, Malhotra and Majchrzak, 2004, Paul, 2006).

The diversity of team members’ individual backgrounds is a significant factor that influences virtual team performance because individual cultural values can seriously affect members’ attitude to social interaction (Maznevski and Chudoba, 2000). For example, a Taiwanese is influenced by Confucian values so he or she emphasis collectivism and harmony in the workplace and teamwork (Zhu et al., 2000). In addition, knowledge sharing between virtual team members should be emphasised because knowledge creation is an important function of a virtual team, as a virtual
team is considered as a new organisational form which can create the knowledge to overcome the challenges of a knowledge-based workforce (Lipnack and Stamps, 2000). Therefore, this study addresses the research gap in human factors investigation by exploring individual cultural competencies and knowledge sharing in a virtual team I-P-O model. The individual cultural competencies issue will be discussed at the inputs stage, while knowledge sharing between virtual team members will be investigated in the processes stage.

**Inputs Stage**

A great challenge of a virtual team is keeping a harmonised operation because virtual team members are more geographically distant individuals than conventional team members, thus, in working in a virtual environment, they must cooperate more effectively (Elron and Vigoda-Gadot, 2006). The cultural diversity of team members’ is a vital characteristic of a virtual team (Maznevski and Chudoba, 2000) and it has both positive and negative effects on the team’s processes and performance. On one hand, team members from different countries may misunderstand each other due to their different values and interpretation (Elron and Vigoda-Gadot, 2006). Stening (1979) reviewed the literature on cross-cultural issues and stated that there are usually several problems, such as communication gaps, stereotype, and prejudice, existing in cross-cultural interactions. On the other hand, some studies support the view that cultural diversity amongst members can benefit team performance, such as in higher levels of creativity (Cox et al., 1991, Watson et al., 1993). As a result, team members’ individual abilities to cope with cultural difference is important for effective virtual teamwork because a person with higher cross-cultural competence can act appropriately and communicate effectively with members from different cultures (Sharma et al., 2009).
An important ability in dealing with cultural difference is cultural intelligence, and it has been discussed at both the group level (Silberstang and London, 2009) and the individual level (Ang et al., 2007). Silberstang and London (2009) stated that groups with a high level of cultural intelligence adapt more easily to the cultural differences within a group and have good performance due to the better communication between group members. Cultural intelligence is a vital competence of group learning when cultural diversity exists within a group. Similar to group cultural intelligence, Ang et al. (2007) also emphasised the importance of individual cultural intelligence in dealing with a culturally diverse situation and defined cultural intelligence as ‘an individual’s capability to function and manage effectively in cultural diverse settings’ (Ang et al., 2007, p.336). People who have higher cultural intelligence can adapt in unfamiliar cultural environments more quickly (Earley and Ang, 2003). The positive relationship between individual cultural intelligence and cultural adaptation has been supported, and the positive effect of individual cultural intelligence on task performance in cross-cultural settings has also been proposed (Ang et al., 2007). Thus, virtual team members’ individual cultural intelligence may affect team cooperation and performance.

Another significant factor in overcoming cultural differences between team members is cultural openness. Cultural openness is determined by ‘willingness to interact with people from other cultures and experience some of their artefacts.’ (Shankarmahesh, 2006, p.149). People who have higher cultural openness can engage in meaningful interactions with others from divergent national and organisational cultures; in addition, developing cultural openness can improve the skills required for intercultural communication (Griffith and Harvey, 2001). Virtual team members’ individual
cultural openness could have positive effects on the fluency of cross-cultural communication as well as knowledge sharing in team interactions.

Self-efficacy is also a crucial individual attitude to working in cross-national environments and it has been discussed in the cross-cultural context (Bandura, 2002). Kim et al. (2008) proposed that cultural intelligence is positively correlated with self-efficacy, and Chen et al. (2000) stated that self-efficacy made unique contributions to work-related performance. Many researchers have frequently discussed the relationship between self-efficacy, collective efficacy, and group performance (Parker, 1994, Little and Madigan, 1997, Mulvey and Klein, 1998, Lent et al., 2006). This study assumes that virtual team members’ self-efficacy could be a critical factor in influencing team performance because personal attitude, such as confidence, will impact on individual behaviours in team cooperation.

Processes Stage
A virtual team’s knowledge sharing should be emphasised because knowledge sharing within a working group can seriously influence the group’s performance (Cummings, 2004). According to Nonaka (2007), knowledge creation is the combination of ‘tacit’ and ‘explicit’ knowledge, and the core action of knowledge creation is transferring personal knowledge to other organisational members. Humans, rather than mechanical processes, mainly contribute knowledge sharing and transfer because knowledge exists in human minds and begins by individuals sharing (Nonaka, 2007). Knowledge sharing behaviour between team members should be examined in virtual team studies. Fishbein and Ajzen’s Theory of Reasoned Action (TRA) has been widely utilised to explain behavioural intentions and actual behaviour (Bock and Kim, 2002). Some researchers (Bock and Kim, 2002, Lin, 2007) have examined and proved the
relationships outlined in Fishbein and Ajzen’s TRA in the knowledge-sharing context. Knowledge sharing behaviour is influenced by personal attitude and intention to share knowledge. Consequently, this research addresses that knowledge sharing should be considered as a significant factor in the processes stage of the virtual team I-P-O model by the investigation of both knowledge sharing willingness and behaviour.

**Outputs Stage**

Previous research has usually utilised task outcome and member satisfaction to measure a virtual team’s output. However, this study only applies member satisfaction to represent a virtual team’s output because this research concentrates on studying at the individual level, such as individual attitudes and feelings. Team members can subjectively measure their satisfaction with team processes and performance but cannot objectively evaluate task outcome. Therefore, this study merely investigates member satisfaction for the outputs stage of a virtual team.

This research proposes a new I-P-O model which is distinctly different from previous literature about virtual teams. A preliminary research structure is that knowledge sharing between members represents a virtual team’s processes stage, and cultural intelligence, cultural openness, and self-efficacy are included in a team’s inputs while member satisfaction represents outputs of a virtual team. Figure 2.1 presents the simple virtual team’s I-P-O model in this research.
2.4 Individual Competencies

This research intends to investigate the influences of individual competencies, including individual cultural intelligence, individual cultural openness, and self-efficacy, on virtual teamwork in order to understand their effects in facilitating a virtual team’s knowledge sharing. Much of the research, which discusses important factors for managing cultural difference, has largely concentrated on cultural intelligence (Thomas and Inkson, 2004, Earley et al., 2006, Ang and Van Dyne, 2008b) and cultural openness (Fujimoto et al., 2000, Strizhakova et al., 2008b). Self-efficacy could also be an important factor in cooperating with others from different cultural backgrounds because it is an individual attitude which influences personal behaviour in a cross-national environment (Bandura, 2002). These three significant factors can influence individual behaviour to collaborate with other team members in a cross-national working environment but have not been discussed enough in previous virtual team research.

2.4.1 Individual Cultural Intelligence

Cultural intelligence (CQ) is a concept used to describe an individual capability that is
developed based on Intelligence Quotient (IQ) and Emotional Intelligence (EQ) (Thomas and Inkson, 2004). Cultural intelligence is, however, distinct from IQ and EQ because CQ focuses on a particular situation in an intercultural or cross-cultural setting, while IQ and EQ explain the ability of logical reasoning and expressing human emotions respectively in general (Ang and Van Dyne, 2008b). Over the past few years, many researchers have tried to define cultural intelligence and this study reviews relevant literature to give an operational definition of individual cultural intelligence in order to conduct this research investigation.

**Definition of Individual Cultural Intelligence**

Most of scholars defined cultural intelligence as an individual ability to deal with cross-cultural situations. Earley and Mosakowski (2004) stated that cultural intelligence is the nature of the ability of an outsider which will help him or her to understand unfamiliar cultures. Ang et al. (2007) suggested that cultural intelligence is a specific form of intelligence concentrated on an individual’s ability to interpret and behave appropriately in culturally diverse settings. Shaffer and Miller (2008) defined cultural intelligence as a personal capability to interact with people who are from different cultural backgrounds more effectively. Effective adapting to new cultural contexts is also emphasised in the cultural intelligence definition. Thomas and Inkson (2004) stated that cultural intelligence can help someone to develop adaptive skills so that he or she can function and manage intercultural situations effectively. The ability to adapt and adjust to new cultural environments is stressed in several studies in explaining cultural intelligence (Earley et al., 2006, Van Dyne et al., 2008).

Some researchers defined cultural intelligence more comprehensively by stating that CQ contains knowledge, skills and behaviour. For instance, Thomas (2006, p.81)
defined that cultural intelligence as ‘consisting of knowledge, mindfulness, and
behavioural ability, and these three components combine to produce the ability to
interact effectively across cultures’, while Earley et al. (2006, p.5) stated that cultural
intelligence consists of ‘three key parts, including cultural strategic thinking,
motivation, and behaviour’.

From the discussions above, four important characteristics, individual ability, adapting
to a new culture, a set of knowledge and skills, and personal attitude, can be found in
the definitions of cultural intelligence. Thus, this research defines cultural intelligence
as an individual ability, composed of knowledge and skills that can help someone to
act and react effectively to cope with cultural differences. For example, someone with
higher cultural intelligence can interact with other people from different cultural
backgrounds better. However, the proposed definition is still ambiguous because of
the meaning of ‘a set of knowledge and skills’ for measuring individual cultural
intelligence in this research. In order to develop clear research assumptions, this study
discusses the conceptualisation of cultural intelligence.

**Conceptualisation of Cultural Intelligence**

The concept of cultural intelligence is a new term proposed by Earley (2002), that is
an individual capability for managing cross-cultural difference in international
business (Thomas, 2006). Since Earley introduced cultural intelligence into the
international business literature in 2002, some researchers have tried to study the
conceptualisation of cultural intelligence in a comprehensive way (Ang and Van Dyne,
2008b, Earley and Ang, 2003, Thomas and Inkson, 2004, Earley and Mosakowski,
Earley and Ang (2003) developed a general structure of cultural intelligence that consists of three facets with cognitive, motivational, and behavioural elements. The first facet, cognitive, is conceptualised by self-theory, identity theory and reasoning frameworks, and ‘the cognitive aspect of cultural intelligence using knowledge of self, knowledge of social environment, and knowledge of information handling’ (Earley and Ang, 2003, p.68). However, a cognitive aspect alone cannot fully represent cultural intelligence because having knowledge of another culture is insufficient to deal with different intercultural situations. Being able to use the knowledge appropriately in reacting to different cultures is more significant (Earley and Ang, 2003). As a result, motivational and behavioural facets are considered as essential factors in cultural intelligence, and they focus on a person’s motives, such as, self-efficacy, and one’s behavioural responses in diverse culture settings, respectively.

Thomas and Inkson (2004) mentioned that cultural intelligence has three parts with knowledge, mindfulness, and behavioural skills, and these three elements are interrelated with each other. Knowledge means understanding what culture is, how cultures differ, and how culture influences one’s behaviour, whereas mindfulness is defined as ‘the ability to pay attention in a reflective and creative way to cues in the cross-cultural situations encountered’ (Thomas and Inkson, 2004, p.15). Culturally intelligent people require knowledge of culture, and, further, they need to practice mindfulness. Finally, behaviour skills, for example, choosing the appropriate and correct behaviour for different intercultural situations, can be developed based on the well of knowledge and mindfulness. To conclude, a person becoming more culturally intelligent needs to go through the process whereby each new challenge is built upon another, as a repeated cycle, and then, finally, achieving high cultural intelligence (Thomas and Inkson, 2004).
Earley and Mosakowski (2004) developed three categories for diagnosing cultural intelligence by discussing three sources of cultural intelligence in individuals being head, body, and heart. The first source, the head, means that people need to devise learning strategies for understanding other cultures, such as traditions, beliefs and taboos, in order to prevent different troubles, and so it is considered as personal cognitive CQ. Another source, the body, refers to the proverb of ‘when in Rome, do as the Romans do’, and that is regarded as individual physical CQ. The third source is the heart, and that explains the importance of confidence in adapting to a new culture, so it mentions personal emotional/motivational CQ. For example, a person would stop trying to adjust in new culture if he or she does not have confidence in understanding people from different cultures. From the descriptions above, these three categories are similar to the cognitive CQ, behavioural CQ, and motivational CQ, introduced by Earley and Ang (2003).

Based on previous research, Ang and Van Dyne (2008a) discussed cultural intelligence in a comprehensive explanation and proposed a description of cultural intelligence that contains four different categories of cultural intelligence; metacognitive, cognitive, motivational, and behavioural. First, metacognitive CQ is the consciousness and awareness of an individual when he or she interacts with people who are from different cultural backgrounds. The metacognitive factor is a vital element in cultural intelligence because it not only provides for an individual’s active and critical thinking about people, situations, customs, and assumptions in different cultural settings, but also enhances an individual’s ability to understand other cultures by revising their mental maps (Ang and Van Dyne, 2008a). Second, cognitive CQ is an individual’s cultural knowledge, and it includes knowledge of cultural similarities
as well as knowledge of cultural differences. It is an important factor in cultural intelligence because human thoughts and behaviours will be impacted seriously by their cultural knowledge. For example, people can perform better in cross-cultural situations by understanding a new society’s culture. Third, motivational CQ is the capacity of an individual to direct personal attention and energy into learning how to function in different cultural settings. As Van Dyne et al. (2008, p.17) defined motivational CQ as a ‘special form of self-efficacy and intrinsic motivation in cross-cultural situation’, emotions and affections can influence motivational CQ significantly. People with high motivational CQ are usually confident in dealing within a culturally diverse environment. Finally, behavioural CQ is a personal ability to express verbal (e.g., speech and oral conversation) and nonverbal (e.g., gesture, posture and eye contact) actions appropriately when interacting with people from different cultural backgrounds. Behavioural factors are critical component of cultural intelligence because they can be clearly observed in interactions, and then, directly influence observers’ evaluation.

**Ang and Van Dyne’s Four Factors Model**

Previous research into cultural intelligence in cross-cultural management has frequently investigated cultural intelligence as a multidimensional construct, and the four-factor model of cultural intelligence is the most commonly discussed. For example, Brislin et al. (2006) mentioned that cultural intelligence can be developed by personal behaviour, cognitions, emotions, and awareness in adapting to different cultural environments, and that cultural intelligence is a set of skills that allows an individual to adjust to other cultures better. Ang et al (2006) examined a four-factor measurement of CQ; meta-cognitive, cognitive, motivational, and behavioural, and presented validity evidence. Furthermore, Ang et al. (2007) demonstrated a consistent
pattern of relationships between four factors of cultural intelligence; cultural judgement and decision making, cultural adaptation, and task performance. The four-factor structure of cultural intelligence proposed was supported in a large sample of international students in the research of Ward et al. (2009).

Investigating the concept of cultural intelligence in research into virtual teams will progress academic study given that cultural intelligence has not previously been examined in virtual environments. Cultural intelligence can be considered as a significant factor that has impact on virtual teamwork in a cross-national environment because it can influence team collaboration (Ang and Van Dyne, 2008b, Ang and Van Dyne, 2008a). Moreover, the positive effect of individual cultural intelligence on task performance in cross-cultural settings has been proposed (Ang et al., 2007). It is arguable that the cultural intelligence of individual virtual team members will probably affect team interactions and effectiveness. As a result, this research emphasises the cultural intelligence of individuals in the investigation by applying Ang and Van Dyne’s (2008a) four factors, because Ang and Van Dyne’s four factors model (2008a) has been accepted as the most complete multidimensional construct of cultural intelligence in past studies.

2.4.2 Individual Cultural Openness

Cultural openness, which has sometimes been mentioned by other terms such as openness to culture or dissimilarity openness, has been examined in many psychology (Cheung et al., 2008), marketing (Sharma et al., 1994, Strizhakova et al., 2008b) and organisation management (Härtel, 2004, Hobman et al., 2004) research projects. Ang et al. (2006) examined differential relationships between Big Five personality traits and the four facets of cultural intelligence, meta-cognitive, cognitive, motivational,
and behavioural, and found that openness related to all four facets of cultural intelligence. The results show that openness can be considered as the most important influential factor to cultural intelligence because it has an obvious relationship with all four of the dimensions of cultural intelligence. Consequently, the effect of openness, especially openness to different cultures, is essential to investigation in this research.

**Definition of Individual Cultural Openness**

Sharma et al. (1994) defined cultural openness as an individual’s willingness to interact with people from different cultures and to experience values and artefacts of other cultures. Wenger (1999) stated that cultural openness is an individual attitude and self-awareness toward different cultures, and it is a continuous development of cross-cultural skills in a person’s lifetime.

Another description commonly used to explain cultural openness is dissimilarity openness. Fujimoto et al. (2004) utilised the term ‘openness to perceived dissimilarity’ to describe an individual’s openness to perceived differences. While Härtel (2004) indicated that diversity openness is an individual attitude toward differences, which also means the degree of willingness to accept dissimilarity perceived by a person. The different level of diversity openness will influence an individual to function and cooperate more or less effectively in the workplace (Fujimoto et al., 2004, Härtel, 2004).

Finally, the definition of openness within a cross-cultural perspective is emphasised by Cheung et al. (2008) and Strizhakova et al. (2008b). Cheung et al. (2008) stated that openness is related to the degree of tolerance for ambiguity and the motivation to access different thoughts and experiences. Meanwhile, Strizhakova et al. (2008b, p.60)
defined cultural openness more specifically as ‘a person’s interest in, and experience with, foreign people, values, and cultures’.

To summarise the discussions above, cultural openness can be considered as a set of individual attitudes regarding different cultures, which can help individuals to communicate with people from diverse cultures more actively. Consequently, this research defines cultural openness as an individual’s attitude and willingness to make contact with unfamiliar cultures. People with high cultural openness are open to interacting with, and learning from, others who have different cultural backgrounds.

**Fujimoto et al.’s Dissimilarity Openness Concept**

This research focuses on the effect of individual cultural openness on virtual teamwork, which is a new form of workgroup. Although many researchers have investigated the concept of cultural openness in studies for international marketing (Sharma et al., 1994, Shankarmahesh, 2006, Strizhakova et al., 2008b), only a small number of them concentrated on a discussion of a workgroup. Previous studies in international human resource management (Härtel, 2004) and workgroup research (Fujimoto and Härtel, 2004, Fujimoto et al., 2004, Fujimoto et al., 2000) commonly utilised the term, dissimilarity openness, to discuss the individual cultural openness. Fujimoto et al. (2004, p.6) stated that ‘individuals high on the dimension of openness to perceived dissimilarity view difference as a positive, and are open to learn from dissimilar others’. This explanation is similar to the definition of cultural openness in the study that focuses on individual attitude towards cultural diversity. As a result, this research will apply the concept of dissimilarity openness stated by Fujimoto et al. (2004) to measure individual cultural openness in the research investigation.
2.4.3 Self-efficacy

Self-efficacy is another vital factor that influences virtual teamwork in a cross-national environment. This research presumes that individual ability and attitude can impact on individual behaviours in sharing personal knowledge in a virtual teamwork. Thomas and Inkson (2004) proposed that individual behaviour is significantly motivated by the sense and understanding of self. The sense of self and understanding one’s own belief is similar to the concept of self-efficacy because self-efficacy stresses the self-belief of one’s personal ability. As self-efficacy is a core variable developed by social cognitive theory, it is necessary to first discuss Bandura’s (1986) social cognitive theory.

*Bandura’s Social Cognitive Theory*

Many scholars have discussed Bandura’s social cognitive theory in different research areas, such as social psychology (Parker, 1994, Judge et al., 2007), organisational behaviour (Little and Madigan, 1997, Lent et al., 2006, Neck et al., 1999) and cross-cultural management (Lam et al., 2002). Bandura’s (1986) social cognitive theory states that people are not only driven by either inner or external factors, because human actions depend on using five different capabilities; symbolising capability, forethought capability, vicarious capability, self-regulatory capability and self-reflective capability. Based on the concept that people’s behaviour is being influenced by five different capabilities, human functioning can be described as a triadic reciprocity model in which behaviour, cognitive and other personal factors, and environmental events can influence each other.

The core concept in social cognitive theory is self-efficacy; and, as Bandura (1986) indicated, the most influential aspect in people’s everyday lives is their concept of
their personal efficacy. Perceived self-efficacy is a judgment of one’s capability to achieve a goal, and this kind of judgment can seriously impact on personal performance (Bandura, 1986). Moreover, judgements of self-efficacy are functionally related to action and can influence the level of motivation (Bandura, 1986). For example, people may choose to perform certain activities when they possess many of the basic skills and have a strong sense of efficacy and that they perform well. As a result, self-efficacy is a vital factor in investigating an individual’s competence to perform certain behaviours, and it should be applied in virtual team research.

**Definition of Self-efficacy**

Self-efficacy has been regarded as one of the vital concepts in contemporary psychology research, and it has been investigated frequently in various studies over the past 25 years (Judge et al., 2007). Scholars have commonly discussed self-efficacy in industrial-organisational psychology research. For example, researchers have utilised self-efficacy in organisational management studies, such as leadership (Chen and Bliese, 2002), negotiation (Stevens and Gist, 1997), group-team processes (Feltz and Lirgg, 1998) and performance (Bartol et al., 2001, Judge et al., 2007). Definitions of self-efficacy in previous research are mostly consistent with Bandura’s statement (1986) that self-efficacy is an individual judgment of one’s ability, regardless of actual skills but refers to perceived personal capability, and this self-awareness will influence the actions of an individual.

Following Bandura’s (1986) definition of self-efficacy, Parker et al. (1994) and Little and Madigan (1997) also stressed the role of personal judgment in describing the concept of self-efficacy. Parker et al. (1994) stated that self-efficacy refers to personal judgment about individual ability, and this judgment is associated with motivation and
personal achievement. Little and Madigan (1997) mentioned that self-efficacy is an individual judgment about what one can do, without understanding of the skills one possesses, and that this self-belief influences personal actions. Further, individual belief is proposed as a clearer explanation in defining self-efficacy. Lent et al. (2006) defined self-efficacy as where an individual believes that he or she has the capability and skills to perform a particular behaviour. Judge et al. (2007) stated that self-efficacy is a person’s beliefs about his or her ability to achieve designated types of performance. The significant effect of individual beliefs on personal behaviour performance has been proposed in the self-efficacy concept, that ‘the major thrust of self-efficacy theory is that individual perceptions of personal ability to overcome challenges directly correspond with behavioural performance’ (Neck et al., 1999, p.491).

From the discussions above, this study considers self-efficacy as an individual belief about one’s own ability to perform actions. It is a judgment rather than a real skill. It could be possible that people have high self-efficacy but do not have real skills. For example, a person who may believe he or she can be the winner in a dancing competition, but lacks the skill to win the first stage. However, self-efficacy is still a significant influential factor that affects individual performance because it is unlikely that people with low self-efficacy would take positive action and the outcome would probably be poor. Based on the operational definition of virtual teams in this research, virtual team members must cooperate with people from different countries. As a result, self-efficacy, as defined in this study, is more likely an individual belief of one’s ability to produce good task performance in a cross-national virtual team, and it implies individual competence for overcoming differences in members’ national background.
Bandura’s Social Cognitive Theory and Self-efficacy

Since social cognitive theory has stated that interactions between three elements, including personal cognitive factors, behaviour and external environment/external outcome, can strongly influence social learning and knowledge learning in humans (Bandura, 1986), it is used as a base to study knowledge sharing and cooperation behaviour in teamwork. Social cognitive theory can be applied in virtual environments because some previous research has used it to discuss knowledge transfer in a virtual team or community (Chiu et al., 2006, Staples and Webster, 2007), and investigated the core theory of Bandura’s social cognitive theory, self-efficacy.

Previous research has investigated the relationship between self-efficacy, individual behaviour, and individual performance in the workplace. Gibson and Dembo (1984) stated that teachers with high self-efficacy would create a positive academic learning environment for their students by spending more time in academic activities. Parker (1994) also mentioned that the relationship between teachers’ self-efficacy and students’ performance is reciprocal because teachers’ self-efficacy might affect students’ performance and then influence their own judgments for future teaching. Moreover, Neck et al. (1999) proposed that entrepreneurs with positive self-efficacy perceptions would perform better than those with negative self-efficacy perceptions. Lam et al. (2002) showed that self-efficacy is an important moderator because there is a positive relationship between perceptions in participative decision-making and individual performance when people have high participation self-efficacy.

Self-efficacy may impact on individual performance and also on team performance, and some research has discussed the relationship between self-efficacy, collective
efficacy and team performance. Lent et al. (2006) stated that beliefs about collective efficacy, which are predicted by the combination of cohesion and self-efficacy, would serve as stronger predictors of team performance. Judge et al. (2007) examined the effect of self-efficacy on work-related performance, controlling for general metal ability, Big Five personality traits, and experience. Self-efficacy has its contribution to work-related performance and ‘individual differences are at least as important as self-efficacy’ in influencing performance (Judge et al., 2007, p.115). From the discussion above, self-efficacy can be regarded as a crucial factor in influencing individual behaviour and performance, even in team performance. Therefore, this research applies Bandura’s social cognitive theory (1986) in the discussion of the influences of self-efficacy on cross-national virtual teamwork.

2.5 Knowledge Sharing

This research emphasises knowledge sharing in the processes stage of teamwork as there is a lack of discussion of knowledge sharing in the existing virtual team I-P-O model research. This study investigates knowledge sharing behaviour in virtual teams by applying Nonaka’s knowledge transfer SECI model and discusses the relationship between knowledge sharing willingness and knowledge sharing behaviour by utilising Fishbein and Ajzen’s Theory of Reasoned Action (TRA).

2.5.1 Knowledge Sharing Behaviour

Knowledge sharing has been identified as an issue in knowledge management and which Nonaka’s SECI model has commonly utilised in previous research. Nonaka (1994) categorised knowledge into two types, tacit and explicit, and developed a model (SECI) of the knowledge creation process. According to Nonaka (2007), humans, rather than mechanical processes, mainly contribute knowledge sharing and
transfer because knowledge exists in human minds and begins when individuals share. Knowledge creation is the combination of tacit and explicit knowledge, and it is a continuous cycle which includes four basic processes, socialisation (from tacit to tacit), externalisation (from tacit to explicit), combination (from explicit to explicit), and internalisation (from explicit to tacit) (Nonaka and Konno, 1998). In other words, the core action of knowledge creation is transferring personal knowledge to other members of the organisation (Nonaka, 2007).

**Definition of Knowledge Sharing Behaviour**

Based on the concept of the knowledge creation process (Nonaka, 1994), this study considers knowledge sharing in a team as the process where team members provide their tacit knowledge so that it becomes explicit group knowledge, and they can also learn from other members by changing explicit collective knowledge into personal tacit knowledge. Many researchers have widely discussed and applied the concept of Nonaka’s knowledge transfer in different organisations. Rynes et al. (2001) examined knowledge transfer between academics and practitioners by utilising Nonaka’s knowledge conversion process. Rice and Rice (2005) also investigated the accumulation of organisational knowledge and learning processes within inter-organisational projects-based alliances by using Nonaka and Takeuchi’s SECI knowledge sharing model. ‘The transfer of SECI principles to multi-organisational projects and alliance arrangements will allow for better and more effective knowledge management across organisational boundaries’ (Rice and Rice, 2005, p.679). Rice and Rice (2005) stressed that applying the key elements of the SECI model across organisational limits, and working out how to employ SECI principles inter-organisationally might create benefits for multi-organisational endeavours.
Nonaka’s model of organisational knowledge creation has been applied to study conventional teams as well. Zárraga-Oberty and Saá-Pérez (2006) summarised Nonaka and Takeuchi’s (1995) and Grant’s (1996) ideas about knowledge creation and conceptualised knowledge management in work teams, suggesting that knowledge management, a process of creation, transfer, and integration, can happen in work teams, especially in teams that have certain characteristics, including self-management, leadership, individual autonomy, a climate of trust, a common understanding, and that members are heterogeneous and complementary.

Several studies discussed Nonaka’s SECI model in the virtual environment. Curşeu et al. (2008) proposed an integrative model to describe information processing in virtual teams by combining Gibson’s (2001) information processing and Nonaka and Takeuchi’s (1995) knowledge creation process. The interaction between communication and group memory is especially important for virtual teams because communication technologies (CTs) directly affects the use of knowledge in virtual teams and indirectly influences team information processes by facilitating the emergence of trust, coordination, and cohesion (Curşeu et al., 2008). While Samarah et al. (2008) constructed a new research model in which he outlined the role played by knowledge conversion in the relationship between CTs supported and shared understanding. The level of technology support affects knowledge conversion and shared understanding in Group Support System (GSS)-aided virtual teams; also, a member’s willingness to share knowledge can influence knowledge conversion in GSS-aided virtual teams (Samarah et al., 2008).

From the discussion above, Nonaka and Takeuchi’s theory of organisational knowledge creation has been widely applied to research into organisations and
conventional teams. By contrast, not many researchers have investigated Nonaka’s SECI model in a virtual setting. Thus, examining the SECI model in a virtual environment is important in addressing the lack of academic research literature, and this study intends to utilise Nonaka’s organisational knowledge conversion model to discuss knowledge sharing behaviour in virtual teams.

**The Externalisation and Internalisation of Nonaka’s SECI Model**

This study emphasises only the externalisation and internalisation factors of Nonaka’s SECI model because investigating externalisation and internalisation represents most of the knowledge sharing activities in a virtual team. ‘Knowledge is often defined as internalised information and understood as a blend of explicit and tacit elements’ (Widén-Wulff and Suomi, 2007); accordingly, knowledge sharing activities can be considered as a series of conversations and actions that begin with an individual introducing his or her knowledge to the group and ends with the individual obtaining new knowledge from his or her group interaction. However, given the definition of a virtual team in this research, that members work together with team members from different countries, it is arguably not possible to investigate socialisation, which in the model requires face-to-face contact, to such teams. The element, combination, is also not considered in this research investigation because it is highly related to information technology development, such as database design and transaction memory systems, but it is not a human factor.

In fact, the main concept of knowledge sharing is to change personal tacit knowledge into group knowledge and then people can enhance their knowledge through collective action taken from the group experience (Papacharalambous and McCalman, 2004a). Applying externalisation and internalisation as per Nonaka’s SECI model is
suitable to investigate knowledge sharing behaviour in virtual teams. In this study, externalisation is defined as individual tacit knowledge being translated to comprehensive forms which can be easily understood by other team members, while internalisation is defined as people integrating new knowledge into their own tacit knowledge by absorbing translated knowledge within a team (Nonaka and Konno, 1998).

2.5.2 Knowledge Sharing Willingness

Knowledge sharing involves the process of transmitting existing knowledge between team members, and the vital factor in knowledge sharing is that each team member has the ability and willingness to share their own knowledge in team interaction (Rosen et al., 2007). Previous studies also showed that people are usually not willing to share their knowledge (Ciborra and Patriotta, 1998), and knowledge is not always transferred easily, although organisations support the facilitation knowledge exchange between employees (Szulanski, 1996). ‘One of the critical factors determining a virtual community’s success is its members’ motivation to actively participate in community knowledge generation and sharing activities’ (Ardichvili et al., 2003, p.64). Therefore, it is necessary to concentrate on investigating a member’s attitude and willingness to share knowledge in the virtual team.

Defining Knowledge Sharing Willingness by Fishbein and Ajzen’s TRA

Samarch et al. (2008) investigated Nonaka’s knowledge conversion in GSS-aided virtual teams and outlined the concept ‘willingness to share knowledge’ as the perceptive factor that affects knowledge conversion. The member’s willingness to share knowledge is positively related to knowledge conversion because team members are more willing to, and actually do, share knowledge with each other,
which means the knowledge conversion will be smoother and richer in virtual teams (Samarah et al., 2008). Similarly, two studies (Bock and Kim, 2002, Lin, 2007) have investigated the relationship between individual attitudes to share personal knowledge and knowledge sharing behaviour by utilising Fishbein and Ajzen’s Theory of Reasoned Action (TRA). Fishbein and Ajzen’s TRA (1975) has been widely utilised to explain behavioural intentions and actual behaviour and ‘TRA can be a useful model for explaining the knowledge sharing in organisations’ (Bock and Kim, 2002, p.15). According to Fishbein and Ajzen (2010), the intention to perform behaviour is an indication of a person’s willingness to do a specific action, and individual attitudes toward behaviour will influence individual intentions to perform that behaviour, which is an indication of a person’s willingness to do an action. Therefore, it can be considered that individual knowledge sharing willingness contains two sources, attitude and intention to share personal knowledge, and these should be considered as the main determinants of virtual teams’ knowledge sharing behaviour.

2.6 Member’s Satisfaction

Definition of Member’s Satisfaction

This study follows studies that member’s satisfaction, which is one of most frequently used measures, for investigating a virtual team’s output. ‘The virtual team research on outputs, or outcomes, has focused on the performance, such as effectiveness, of the team’ (Powell et al., 2004 , p.12). Performance can be defined, either broadly or specifically, in different research. For example, Driskell et al. (2003) simply addressed virtual team performance in a broad definition whereas other researchers examined it by more specific measures, such as time required, decision quality, productivity, goal accomplishments, and so on (Geister et al., 2006, Martins et al., 2004, Ortiz de Guinea et al., 2005). According to Smith et al. (1995), cooperation is highly related to task
outcome because cooperation will not continue if the outcome is not good enough. Moreover, the definition of cooperation in past studies mainly focused on the process of group interaction and the individuals’ psychological relationship (Smith et al., 1995). In this study, the definition of member satisfaction is the individual’s satisfaction level with the cooperation between team members. Gladstein (1984) measured member satisfaction by three scales, team satisfaction/satisfaction with being a team member; work satisfaction/satisfaction with job, advancement and so on; and satisfaction with serving the customer. Only team satisfaction and work satisfaction can be considered in this research since satisfaction with serving the customer cannot be applied in the study. Therefore, this research investigates member satisfaction by utilising satisfaction with outcomes of cooperation, and satisfaction with processes of cooperation. Satisfaction with outcomes of cooperation is defined as an individual’s satisfaction level with the team performance, including task outcome and quality, while satisfaction with the process of cooperation is defined as an individual’s satisfaction level with the relationship between team members in the cooperation process (Gladstein, 1984).

2.7 Research Hypotheses for Human Factors Investigation

After discussing influential human factors, individual competencies, team’s knowledge sharing, and member’s satisfaction, based on the virtual team’s I-P-O model, this research tries to answer the central research question of what human factors can affect virtual teamwork. This study develops research hypotheses for obtaining quantitative evidence in the investigation.

Influences of Individual Cultural Intelligence

Several researchers have discussed the relationship between cultural intelligence and
team/individual interactions. Ang and Van Dyne (2008b) demonstrated that cultural intelligence will affect multicultural team functioning, such as conflict, trust, cohesiveness, and cooperation, and will positively influence individual attitudes to collaboration. Gibson and Dibble (2008) also emphasised that cultural intelligence will influence collaboration. Although past studies only mentioned the term of cooperation or collaboration, knowledge sharing within a team could be considered as a similar concept in this research. The reason is that sharing personal knowledge between team members is a kind of cooperation/collaboration within a team. There are two facets emphasised to investigate knowledge sharing, including knowledge sharing willingness and behaviour, in this virtual team study. As mentioned earlier, this research applies Ang and Van Dyne’s four factors (2008a) to measure individual cultural intelligence in the virtual teamwork. Consequently, this study tries to examine the effects of individual cultural intelligence on knowledge sharing and assumes that an individual who has a higher level of cultural intelligence is more willing to share personal knowledge and more actively to enact knowledge sharing behaviour in a team.

**Hypothesis 1:** Individual cultural intelligence will positively affect a cross-national virtual team’s knowledge sharing.

(a) A team member with higher individual cultural intelligence will have higher knowledge sharing willingness for virtual teamwork.

(b) Team members’ individual cultural intelligence will positively influence virtual team’s knowledge sharing behaviour.

**Influences of Individual Cultural Openness**

Fujimoto et al. (2004) investigated perceived the dissimilarity openness moderator
model (PDQMM) and found that the openness to perceived dissimilarity can obviously moderate the influence of diversity in group processes and outcomes. Openness to perceived dissimilarity can be considered as cultural openness due to the similar concept. Group processes and outcomes include affective processes and outcomes, such as commitment and satisfaction, behavioural, e.g., task coordination and social integration, and cognitive, i.e., innovativeness and quality of ideas. Therefore, cultural openness could influence the effect of cross-national diversity on virtual team effectiveness, including team coordination and collaboration. In this study, knowledge sharing between team members is a kind of cooperation/collaboration within a team and it is stressed as important social interaction in the virtual team. As a result, this research assumes that individual cultural openness positively affects knowledge sharing, including knowledge sharing willingness and behaviour, in a virtual team.

Hypothesis 2: Individual cultural openness will positively affect a cross-national virtual team’s knowledge sharing.

(a) A team member with higher individual cultural openness will have higher knowledge sharing willingness for virtual teamwork.

(b) Team members’ individual cultural openness will positively influence virtual team’s knowledge sharing behaviour.

Influences of Self-efficacy

Self-efficacy emphasises that the belief of personal ability can seriously affect an individual’s behaviour and performance as self-evaluation regulates individual reactions (Bandura, 1986). Of all personal cognitive factors that impact on human behaviour, self-belief is stressed the most because it can control a person’s thinking,
feeling, and action. For example, people are more willing to face challenges and take positive action if they believe they have enough ability to produce the desirable outcomes. Moreover, self-efficacy can be examined in a virtual setting because some researchers (Chiu et al., 2006, Staples and Webster, 2007) have investigated it to discuss knowledge transfer within virtual teams/communities. Thus, this research presumes that the level of self-efficacy will positively influence a virtual team’s knowledge sharing, including knowledge sharing willingness and behaviour.

**Hypothesis 3: Self-efficacy will positively affect a cross-national virtual team’s knowledge sharing.**

(a) A team member with higher self-efficacy will have higher knowledge sharing willingness for virtual teamwork.

(b) Team members’ self-efficacy will positively influence virtual team’s knowledge sharing behaviour.

**Correlations between Individual Competencies**

Ang et al. (2006) have found that openness is positively related to cultural intelligence. Moreover, Thomas and Inkson (2004) pointed out that people with high openness/open-mindedness can easily develop cultural intelligence through interacting with people from different cultures because they have the curiosity to pursue knowledge. This research defines openness as an individual’s attitude and concentrates on openness to perceived cultural dissimilarity only. According to Ang et al. (2006), openness is a crucial factor that influences cultural intelligence. Investigating the relationship between culture openness and cultural intelligence is significant because few researchers have examined it. This study assumes that cultural intelligence and cultural openness are correlated with each other.
Social cognitive theory in the cross-cultural context has been deeply discussed in Bandura’s article (2002). Social characteristics and individual value powerfully influence personal cognitive factors and behaviour (Bandura, 1986) because people from different cultures usually have diverse thoughts and feelings. Moreover, one study (Kim et al., 2008) stated that cultural intelligence is positively correlated with self-efficacy while Thomas and Inkson (2004, p.65) mentioned that, ‘understanding oneself is a fundamental base for cultural intelligence’. Self-efficacy connects with individual cultural intelligence and with individual cultural openness because self-efficacy is associated with motivation across a variety of situations (Parker, 1994).

**Hypothesis 4: There are positive relationships between individual cultural intelligence, individual cultural openness, and self-efficacy.**

(a) Individual cultural intelligence is positively correlated with individual cultural openness.

(b) Individual cultural openness is positively correlated with self-efficacy.

(c) Individual cultural intelligence is positively correlated with self-efficacy.

**Relationship between Knowledge Sharing Willingness and Behaviour**

This research defines knowledge sharing willingness as individual concepts, including, value, sentiment, opinion, and stereotype, in sharing personal knowledge, and applies the externalisation and internalisation of Nonaka’s SECI model to investigate knowledge sharing behaviour in virtual teams. Fishbein and Ajzen’s (1975) Theory of Reasoned Action (TRA) proposed a relationship between attitude, intention, and behaviour, and stated that attitude includes attraction, value, and sentiment while
opinion, information, and stereotype can be subsumed as intention. The TRA assumes that the performance of a specific behaviour is determined by a person’s intention to perform the behaviour; also, behaviour intention is influenced by a person’s attitude toward the behaviour and subjective norm (Fishbein and Ajzen, 1975). Thus, this study utilises attitude toward knowledge sharing and intention to share knowledge to investigate knowledge sharing willingness. Attitude toward knowledge sharing is defined ‘the degree of one’s positive feeling about sharing one’s knowledge’ (Bock and Kim, 2002, p.16), while intention to share knowledge is defined as ‘the degree to which one believes that one will engage in a knowledge sharing act’ (Bock and Kim, 2002, p.16). Since some researchers (Bock and Kim, 2002, Lin, 2007) have examined and proved the relationships of Fishbein and Ajzen’s TRA in the knowledge-sharing context, this study assumes that knowledge sharing willingness will affect knowledge sharing behaviour positively.

Hypothesis 5: Knowledge sharing willingness will positively influence knowledge sharing behaviour in a cross-national virtual team.

Effects of Team’s Knowledge Sharing

Knowledge transfer/sharing is important in organisations because it can seriously influence the effectiveness of organisations (Argote et al., 2003). Cummings (2004) discussed the relationship between knowledge sharing and performance and found that the success of knowledge sharing, both intragroup and intergroup, can improve group performance. Thus, this thesis presumes that knowledge sharing is a significant factor in the processes stage of virtual teamwork and affects team performance positively. Moreover, this study believes individual attitudes, such as confidence and willingness, can affect individual behaviour, and then, influence team performance;
hence, this research assumes that knowledge sharing between virtual team members should have the significant influential effect on team performance. Task effectiveness and team members’ satisfaction are commonly utilised to investigate team performance (Hambley et al., 2007). In this study, individual attitude is the main concern so that this research investigates team performance by measuring members’ satisfaction, including satisfaction with outcomes and processes of cooperation, but not the actual task outcome.


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Hypothesis 6: Knowledge sharing within a cross-national virtual team will positively affect member’s satisfaction.

(a) Knowledge sharing willingness will positively influence a team member’s satisfaction with the teamwork.

(b) Knowledge sharing behaviour will positively influence a team member’s satisfaction with the teamwork.

Indirect Effects of Individual Competencies on Members’ Satisfaction

This research assumes that individual competencies, individual cultural intelligence, individual cultural openness, and self-efficacy, can positively influence knowledge sharing between virtual team members. Moreover, the positive effect of knowledge sharing within a team on virtual team members’ satisfaction is also proposed. It is arguable that members’ satisfaction can be influenced by individual competencies through the intervening effect of knowledge sharing. As a result, this research presumes that members’ satisfaction in a cross-national virtual teamwork will be impacted indirectly by individual competencies.

Hypothesis 7: Individual competencies have indirect effects on a member’s
satisfaction through the influence of the team’s knowledge sharing.

By developing the research hypotheses above, this study can propose relationships between all observed human factors in a virtual team’s I-P-O model as shown in the Figure 2.2. The effects of human factors that may influence virtual teamwork in a cross-national environment is clearly defined and can be investigated by the use of a quantitative approach.
Figure 2.2: Virtual team’s I-P-O model built with research hypotheses in this study
2.8 Summary

By reviewing relevant studies of both conventional and virtual teams, this research identified a gap in the research on virtual teams in that human factors influencing team outcomes were given little attention. Based on the discussion of the I-P-O model, this chapter provided a simple virtual team model with research hypotheses that can explain relationships between observed human factors in research investigation. In the inputs stage, individual cultural intelligence, individual cultural openness, and self-efficacy are considered as critical elements in influencing knowledge sharing processes, and the relationship between those three factors has been identified. A virtual team’s knowledge sharing is regarded as the processes stage, and the positive relationship between knowledge sharing willingness and behaviour has been proposed. Member’s satisfaction is used to measure virtual team output in the I-P-O model.

After clarifying the effects of the human factors that have been investigated on virtual teamwork, this study can examine research hypotheses by the use of quantitative analysis to answer a central research question of ‘what are the main human factors affecting the virtual teamwork in the cross-national environment’. However, investigating research hypotheses through quantitative techniques will not help to answer why those investigated human factors can (or cannot) influence virtual teamwork. Moreover, they do not help to identify other potential factors that could have important influences on a virtual team. In order to produce more complete understanding of the virtual teamwork in the cross-national environment, this research also used qualitative analysis to explore the reasons for the relationships and to identify additional factors influencing the operation of virtual teams. Chapter 3 provides the fundamental discussion that further explains and builds the theoretical framework of virtual teamwork.
Chapter 3: Potential Factors and Building Virtual Teamwork Model

3.1 Introduction

In Chapter 2, research model was developed from a review of relevant literature mapping the influence of a range of human factors on effectiveness of virtual teams as measured by members’ satisfaction with the virtual team operation. This chapter provides discussion of other potential factors that could affect virtual team cooperation. By providing potential factors in the discussion of virtual teamwork, this chapter draws attention from the concentration of quantitative investigation toward the enrichment of a theoretical framework. This chapter firstly discusses the communication issue in the virtual working environment and its potential effects on virtual team cooperation. The chapter then explores the influences of trust and leadership in two different sections to stress that these two factors could be important moderators in the virtual team I-P-O model. Finally, a preliminary framework of virtual teams is developed with a research proposition for building the study structure. Using a concurrent mixed method is important in the study to obtain a comprehensive understanding and to build a model of virtual teamwork.

3.2 Communication

Communication within a virtual team plays an important role in influencing team effectiveness because it is a process for sharing personal information to achieve shared mutual knowledge among team members (Liu et al., 2010). However, communication between virtual team members is not easy because computer-mediated environment cannot reach ‘co-presence of communication’ that group members can have with physical contacts with one another at the same location.
The global context within which virtual teams are commonly found suggests that cross-cultural differences in communication behaviour in a virtual team should also be investigated (Jarvenpaa and Leidner, 1999). Although Lee-Kelly and Sankey (2008) investigated the impacts of cultural difference and time zone on communication and team relations, there is still a lack of discussion of the influence of communication on virtual teamwork in a cross-national environment.

Some researchers have investigated communication media technologies used in virtual teams (Henttonen and Blomqvist, 2005, Malhotra and Majchrzak, 2004, Paul, 2006, Roberts, 2000, Majchrzak et al., 2000). However, it appears from the literature review that much less research has been conducted on the way communication between teammates can affect virtual team interaction and performance.

### 3.2.1 Individual Attitude and Communication Style

Even though the advance of technological mediation, such as high-quality audio-visual presentation of data, can support communications in the virtual environment, there are still differences between face-to-face and computer-based interaction, suggesting that interpersonal communication should be included in virtual team studies. Henttonen and Blomqvist (2005) stated that communication between virtual team members has usually relied on several types of telecommunication media, such as telephone, voice mail, email, videoconferencing and groupware, because team members have difficulty meeting each other for face-to-face meetings. Erasmus et al. (2010) stressed that communication by asynchronous computer messaging systems, such as email, audio and video mails, and electronic discussion board, is classified as the lower level of media richness, whereas face-to-face communications, which rarely occurs in a virtual team, has the highest level of richness. Communications within a virtual team is usually not rich enough for exchanging information and creating a
common set of understanding between members because sharing information with others by technological mediation makes it difficult to establish mutual knowledge as computer-based communications could lose contextual information that would create confusion between team members (Driskell et al., 2003).

As indicated in chapter 2, communication technology has been the main concern of previous virtual team research; however, human communication should also be discussed because humans understand each other by communicating through verbal and nonverbal symbols. Although there are many elements contained in study of the human communication study, including intercultural, organisational, and interpersonal aspects of communication; individual differences in human communication have been pursued by academic researchers for the past half century, and continue to attract even more scholars’ attention today (Richmond and McCroskey, 2008). The individual differences approach for studying human communication is to investigate how different individual characteristics and orientations influence personal responses and reactions to others in the communication (Richmond and McCroskey, 2008). Members of work teams are likely to behave and respond differently in communications within the team. In this approach, the major focus is to discuss that individual’s attitude and feeling in communicating with others. Team members general willingness to communicate with others and the anxiety that they experience when dealing with communication (Richmond and McCroskey, 2008) may be important factors in members’ satisfaction with the team operation.

The individual differences approach can be utilised more meaningfully to discuss communication in the virtual team environment because virtual team members are usually culturally diverse because they are located in and drawn from the workforce
of a number of other countries. Different national backgrounds can make the individual difference between virtual team members more obvious and this influence on a virtual team’s communication is important in the research investigation. This study concentrates on discussing an individual’s attitudes and feelings, such as willingness, fear, and anxiety, in dealing with communication by the use of computer-based media in a virtual team. The focus of communication in the research is the individual psychological feelings experienced when contacting other people in the virtual setting and investigates an individual’s difference in responding to the interpersonal communication, especially mediated social interaction, in the teamwork.

3.2.2 Concentration on Mediated Social Interaction

The main concept of interpersonal communication is the social interaction between people and it tries to answer how individuals can achieve successful communication with one another by using verbal discourse, nonverbal actions, and written discourse; for example, giving information to others, persuading others in negotiations, and providing emotional support to others (Berger, 2008). Even though interpersonal communication is traditionally considered as a process of face-to-face communication between two people in early studies of communication, it is suggested that interpersonal communication can also occur in a virtual environment because social interaction between people can be accomplished through the use of communication technologies, such as computer-based media, telephone, and mobile devices (Berger, 2008). According to Berger (2008), there are six study areas in interpersonal communication research: uncertainty, interpersonal adaptation, message production, relationship development, deceptive communication, and mediated social interaction. In the discussion of virtual team environments, mediated social interaction is the most important issue since social interaction has been increasingly supported by utilising
different types of ICTs, even though face-to-face communication rarely occurs in such environments. Computer-based media, such as email, chat room, and teleconferencing, has become the commonly used channel for business communication. This study concentrates on the effect of mediated social interaction in interpersonal communication and addresses how and why mediated social interaction can influence interpersonal conflict, negotiation, and emotion in a virtual teamwork.

Berger argues that: ‘As the use of these technologies has become progressively more widespread, there has been a concomitant increase in research aimed at understanding their potential individual and social effects’ (Berger, 2008, p.269). When groups use Computer Mediated Communication (CMC) to communicate with each other, some personal information may be filtered out. The loss of individuating information about group members may increase in-group loyalty and this situation could make some group members disapprove or be unwilling behave positively with ‘out-group’ members (Berger, 2008). Moreover, the lack of face-to-face meetings should be considered in the discussion of virtual teamwork as physical contacts usually play a vital role in building interpersonal relationships between team members and can make communication more effective. This research tries to understand the potential impact of the lack of face-to-face meetings and investigates whether social isolation could be produced by the virtual teamwork. This suggests a number of questions which need to be addressed in research. Does the high level use of CMC induce team members to feel socially isolated and lonely in a virtual team? What is the impact of the lack of face-to-face meetings on virtual team members’ attitudes and feelings toward contact with other team members? This study, therefore, explores individual psychological feelings about communicating with other team members without physical contact in order to provide a better understanding of the potential influences that can affect
virtual team cooperation.

3.3 Trust

Trust is a vital factor in making team working successful and effective (Liu et al., 2010) because it can help team members behave collaboratively (Holton, 2001). People are more willing to share their knowledge with somebody they trust because, without fear, they feel more comfortable to share personal insights and concerns (Holton, 2001). Trust may develop through frequent interaction and the building of long-term relationships between team members. It has been suggested that members of conventional teams undertake communication mostly through face-to-face conversations (Hosmer, 1995, Lewicki et al., 1998). In the virtual environment, developing trust between team members is a great challenge, as virtual team members may never have met each other making it difficult to assess a team member’s trustworthiness without any physical contact (Powell et al., 2004). However, as Holton (2001) argues, trust is the basis for successful team formation. It is this important that it is addressed in the investigation of virtual team operation. Similarly, Martins et al. (2004) proposed that trust should be examined as a vital element in the virtual team processes, because trust within a virtual team is positively associated with job satisfaction and team performance. Powell et al. (2004) also considered trust as a factor in the socio-emotional processes of virtual teamwork. Trust is likely to be more difficult in virtual teams because using telecommunication may not facilitate the easy establishment of a strong bond between individuals due to the lack of physical contact.

3.3.1 Interpersonal Trust

This study investigates the influence of interpersonal trust on virtual teamwork by
defining trust as an individual’s faith/confidence in other people and that this attribution will influence the individual’s willingness to interact with others and engage in cooperative behaviour. To date, many definitions of trust have been studied in various research areas, such as micro psychological theories (McAllister, 1995, Lewicki and Bunker, 1996) and social/economics approaches (Cummings and Bromiley, 1996), and the concept of trust has also been discussed in team management research. Lewicki et al. (1998) reviewed literature on trust studies and mentioned that confidence and expectation are two significant elements of trust because an individual’s confidence in other people is the basis for trust. Mellinger (1956) stated that trust is considered as an individual’s confidence in the intention, motives, and abilities of another person who is a partner in a relationship. Deutsch (1960) indicated trusting others is where an individual has confidence that someone else would behave as he or she would hope, such as protecting a personal secret and sharing frank information. Hosmer (1995) and Mayer (1995) stated that the expectation of another’s actions is important in trust because the person who trusts will be more willing to be vulnerable to the actions of the person they trust if he or she expects that they will behave appropriately.

Rousseau et al. (1998) stated that trust is a psychological attitude based on an optimistic expectation of another’s intention, capabilities, and behaviour, and that an individual is more willing to accept vulnerability due to the more positive expectation (cited in Crossman and Lee-Kelley, 2004, p.380). Similarly, Henttonen and Blomqvist (2005) argue that when a person must cooperate with others, trust is the positive expectation of another’s capabilities and friendship that enables them to risk collaborating. Trust within a team describes that team members believe their colleagues try to achieve their expectations on both dependable task completion and
in building a good interpersonal relationship (Furst et al., 1999). Elsewhere trust is defined as ‘an emergent state comprising team member intentions to accept vulnerability based on positive expectations of the intentions or behaviour of the members of the team’ (Kiffin-pertersen, 2004, p.39 quoted from Liu et al., 2008b, p.832). As mentioned above, trust is built through the relationship between a person who trusts and the person they trust. The research suggests that there are three characteristics in the development of trust; confidence in other’s intentions, expectations of each other’s behaviour, and their willingness to be vulnerable, are three characteristics of trusting. One person trusts other people only if he or she has the faith that others’ intentions are trustworthy and has confidence in the capability of others. To conclude, trust is developed as a result of personal judgements of others’ behaviour in the past, and it usually develops gradually over time. Accordingly, this research considers that interpersonal trust is an important issue for the discussion of virtual teamwork because the fundamental requirement to build trust between individuals is inherent in developing an interpersonal relationship.

### 3.3.2 Potential Influences of Interpersonal Trust

Interpersonal trust is a primary attribution in encouraging the successful collaboration within a team and it has been frequently discussed in team studies. Politis (2003) found that interpersonal trust is related to knowledge acquisition that then influences team performance, while Costa (2003) proposed that there is a positive relationship between interpersonal trust and team satisfaction, and Erdem and Ozen (2003) mentioned that teams with higher levels of trust could perform better.

Politis (2003) investigated the relationship between interpersonal trust, knowledge acquisition, and team performance, by surveying 49 self-managing teams. Knowledge
acquisition is more likely related to the concept of team cooperation because it includes many variables of team collaboration, such as communication, problem understanding, control, and negotiation. In Politis’ (2003) research, the importance of interpersonal trust is emphasised because interpersonal trust has significant effects in positively influencing knowledge sharing and collaboration between team members. Costa (2003) examined the relationship between interpersonal trust and team effectiveness by surveying 112 work teams in the Netherlands. Costa (2003) found that trust is essential for the functioning of teams because teams experiencing higher levels of trust usually perform and collaborate better. This is likely to result in high task performance as well as high team satisfaction. Erdem and Ozen (2003) also examined trust in teamwork and found that team performance and two dimensions of trust among team members, cognitive and affective, are positively related.

As mentioned, trust is an important element that influences teamwork; yet, it is difficult to build trust within a virtual team because misunderstanding and misconception are more likely to occur in a virtual setting due to the lack of social interaction. Bierly et al. (2009) examined the moderating effects of virtuality on the antecedents and outcome of trust, and found that the impact of trust on virtual team cooperation is less than that on cooperation within face-to-face teams because of the reduced social relationships. However, it does not mean that trust is not important in virtual teamwork, as stated by Bierly et al.

*The role and importance of trust in virtual teams need to be revaluated; Managers using virtual teams need to realise that interpersonal relationship in virtual teams do not evolve in the same manner as face-to-face teams and may require different management techniques (Bierly et al., 2009, p.551).*

There are some studies that have investigated the influence of trust on team
cooperation and effectiveness in virtual teams. Henttonen and Blomqvist (2005) explored the role of trust in team development and effectiveness of global virtual teams, and found that trust is very significant in the functioning of a virtual team because team members are less willing to interact and contribute in team cooperation if there is a lack of trust within the team. The trust building is usually based on communication behaviour, such as a timely response, in-depth feedback, open communication, caring talk, and personal conversation, so there are many barriers to establishing trust within a virtual team due to the lack of face-to-face conversations. Failure to enhance the evolution of trust may result in poor team interaction and cooperation. Peters and Karren (2009) stated that developing trust among team members might help virtual teamwork to be more successful because a virtual team with heightened trust will ensure that team members are more likely to recognise a spirit of team cooperation and, therefore, be more willing to share information with a diverse group of team members within a virtual team (Peters and Karren, 2009).

Liu et al. (2010) investigated the relationship between virtual team input, process and output variables, including the relationship between trust and team performance. It has been shown that trust is positively related to team effectiveness because ‘even though trust building in virtual teams is more difficult than in traditional teams, members in virtual teams will have higher levels of performance if trust is built’ (Liu et al., 2010, p.183). Peters and Karren (2009) also examined the relationship between trust, functional diversity, and team performance in virtual teams and found that both trust and functional diversity influence team performance positively. Besides, trust also has an indirect effect on team performance, as the impact of functional diversity on team performance will be moderated by the trust among team members (Peters and Karren, 2009).
From the discussions above, this study assumes that interpersonal trust between team members can influence the effectiveness of virtual teamwork. Interpersonal trust is essential to strengthen team collaboration (Politis, 2003), even in the virtual team interaction (Henttonen and Blomqvist, 2005, Peters and Karren, 2009); while, trust among team members is positively related with team performance (Erdem and Ozen, 2003), even with virtual team effectiveness (Liu et al., 2010). However, building interpersonal trust within a virtual team is much more difficult than in a conventional team as virtual team members may never have met each other and this could be a problem for effective team cooperation. The lack of social interaction between team members may create limitations on the effectiveness of virtual team working. This suggests some important issues for research such as: What are an individual’s attitudes and feelings about working with others in a virtual team? Does the lack of interpersonal trust within a team make a team member less willing to collaborate in a virtual environment? This research tries to answer the questions above to understand the effect of interpersonal trust. Consequently, this study intends to investigate interpersonal trust through an in-depth discussion in order to get comprehensive knowledge about virtual teamwork.

3.4 Leadership

The importance of the leader is an influential factor which affects virtual teamwork. Piccoli and Ives (2003) have found an associating relationship between the use of behavioural controls and the trust among virtual team members. Supportive leadership may help levels of engagement and collective efficacy within a team and might facilitate effective virtual team functioning (Cordery and Soo, 2008). Team leadership represents a significant characteristic of effective team performance because team
members need to coordinate and integrate their individual contributions to collective success, and the team leader usually plays an important role in guiding team members’ actions in the right direction. A successful team leader can significantly contribute to the team effectiveness by giving team members the right directions and organising individuals’ work as a whole; these guiding behaviours will help to maximise the progress of teamwork (Zaccaro et al., 2001). There have been a number of studies which have identified the importance of leadership in co-located teams and groups (Zaccaro et al., 2001, Barge, 1996, Sivasubramaniam et al., 2002). However, the critical role played by leadership should also be pursued in the virtual team research. In virtual teams, leaders can facilitate good connections between team members which help develop meaningful communications and the team leader can take responsibility for task completion (Pauleen, 2003b). Pauleen (2003b, pp.153-154) suggested that ‘leadership qualities and practices can lead to effective virtual teams’. Therefore, the importance of the issue of leadership in virtual teams needs to be discussed.

3.4.1 Leader’s Role

This study considers leadership as the role of the virtual team’s leader which is necessary for team cooperation. This critical role of the leader has been widely investigated in team research, such as team effectiveness (Hackman and Walton, 1986), cross-functional teams (Webber, 2002), and project innovation (Somech, 2006). Although leadership has been explained in a variety of perspectives, such as trait, behavioural, and contingency theories, in previous literature, this research focuses only on the role played by a team leader in virtual team cooperation. From definitions of leadership stated in existing team research, the main concern of the discussion of leadership is the role of a team leader and the leader’s actions.
Chen et al. (2008) reviewed literature in leadership research and proposed that the role of the team leader is important. Mintzberg (1973) stated that the role of team leadership played by managers can be classified into three categories, including interpersonal contact, information processing, and decision making which can deals with the daily challenges in the teamwork; while, Jessup (1990) classified leadership roles into administrator, coach, and adviser (Chen et al., 2008, p.305). The leader’s ability and behaviour have also been mentioned. For instance, Hackman and Walton (1986) explained that a good leader can ensure all crucial functions are adequately and appropriately handled in both task achievements and group maintenance (Zaccaro et al., 2001, pp.453-454). Denison et al. (1995) indicated that an efficient leader can respond to the prompt changes in internal and external environments by employing various leadership actions (Chen et al., 2008, p.305). Barge (1996) stressed that the ability of leaders to develop interpersonal relations is the key to leadership because relational management can help build cohesion within a group (Pauleen, 2003b, p.153). Hirst and Mann (2004) emphasised the importance of leader behaviour for effective teamwork, ‘the specific leadership behaviours required to build task orientation, ensure team cooperation, foster innovation, as well as external relations’ (Hirst and Mann, 2004, p.149).

Summarising the views outlined above, it is seen that the role, ability, and behaviour of a leader are three important characteristics of the leader’s behaviour which might influence team effectiveness. In this study the virtual teams were all assembled specifically for this research, using the quasi-experimental design described in Chapter 4. As a result the teams were self-managed with leadership roles shared by team members. The research is thus focussed on the exercise of leadership functions
rather than the role a specific leader.

**3.4.2 Potential Influences of Leader Role**

Team leaders play an important role in facilitating knowledge sharing and helping to build trust within a team, and those leadership behaviours can contribute to team effectiveness (Lee et al., 2010). Leadership actions can moderate the relationships between cross-functional team characteristics, such as functional diversity, allocation of time, and the team climate for developing trust (Webber, 2002). Some leadership theories stress team cooperation as a moderator in investigating how the role of leadership impacts on team effectiveness. For example, Zaccaro et al. (2001) presented a conceptual framework to argue that leadership can influence team effectiveness through the intervening effect of team processes, and the relationship between leadership and team processes has a reciprocal influence, because they influence each other, and together, can affect team effectiveness. Some researchers address leadership as a key factor which has an intervening effect on a team’s characteristics and a team’s outcome (Somech, 2006, Webber, 2002). Webber (2002) stated that the team leader plays a critical role as an agent for quickly developing trust and developing an effective team climate within a team, so the team leader has an important influence on team effectiveness. Somech (2006) highlighted the role of leadership style as a potent determinant on the outcome of functionally heterogeneous teams because leadership style has an intervening effect on the relationship between a team’s reflection and a team’s functional heterogeneity.

Leadership behaviour is highly related to team effectiveness because different leadership styles will produce different results in team operations. For example, teams with leaders who develop member’s abilities and provide appropriate feedback to
team members are more likely to engage in effective team processes than teams with leaders who do not perform these leadership behaviours. Another example of this is that teams with leaders who provide clear performance goals and strategies will have higher team cohesion than teams with leaders who do not display such activities (Zaccaro et al., 2001, pp.464-476). From the views expressed above, we can understand that team performance is impacted by a leader’s behaviour because a leader’s actions or strategies are significant determinants of team effectiveness.

The lack of face-to-face communication in virtual teamwork limits the communication process because of characteristics such as physical appearance, presence and vocal inflexion are not part of the interaction between team members. As a result the role of a leader is potentially more important and needs to be closely examined. Kayworth and Leidner (2002) investigated leadership effectiveness in global virtual teams and suggested that good team leaders have abilities to deal with paradox and contradiction because they can perform multiple leadership roles simultaneously. Pauleen (2003b) stated that leadership is required in a cross-national communication environment because working in a virtual environment will increase the uncertainty of team cooperation and a good leadership style can cope with ambiguity more effectively with virtual teamwork. Building personal relationships with virtual team members is an important job for a leader and it is better to develop interpersonal relationships in the early stages of virtual teamwork (Pauleen, 2003a). Sivunen and Valo (2006) investigated the method used by team leaders in strengthening the team members’ identification with the virtual team found that catering for the individual, giving positive feedback, bringing out common goals, talking up the team activities, and face-to-face meetings, are the most common strategies and actions used by leaders to enhance identification with the virtual team.
Moreover, Chen et al. (2008) examined the importance of the leadership role in improving team effectiveness and proved that ‘diversified leadership roles influence both leadership effectiveness and team trust; both leadership effectiveness and propensity to trust influence team trust, and team trust in turn directly impacts team effectiveness’ (Chen et al., 2008, p.304). To summarise the studies above, this research argues that the role of leadership can impact on virtual team effectiveness either directly or indirectly.

### 3.5 Establishing Preliminary Framework for Virtual Team Investigation

Most of our knowledge about teamwork is based on conventional teams in which all members can communicate face-to-face at the same location; however, virtual teamwork needs to be discussed differently because conflict among team members could easily occur as the absence of physical contact. Nevertheless, the nature of virtual teamwork is still similar to conventional teams and important factors affecting conventional teamwork could also influence virtual teams. By reviewing existing literature in both conventional and virtual team studies, this study addresses the gap of investigation into human factors in virtual teams by developing research hypotheses with a teamwork model, as outlined in Chapter 2.

In this chapter, three factors, communication, trust, and leadership, are discussed as potential elements that can significantly influence virtual teamwork. This research assumes that the effects of individual competencies and knowledge sharing will be impacted by other influential factors, and tries to explore why those human factors being investigated can affect virtual teamwork by discussing the influence of communication, trust, and leadership. A research proposition is stated as follows.

*Proposition 1: the effects of individual competencies on a virtual team’s*
knowledge sharing and performance could be mediated by other influential factors, such as communication, trust, and leadership.

This argument needs to be explored through in-depth qualitative discussion which might reveal the importance of other factors on team operations and outcomes. As a result, a preliminary framework of a virtual team is proposed as outlined in Figure 3.1 below for the research investigation and discussion.

Figure 3.1: The preliminary framework for virtual team investigation

3.6 Summary

In this chapter, other potential factors that can influence virtual teamwork have addressed by reviewing existing studies. The objective of this chapter is to build a framework of a virtual team in order to develop a structure for conducting the study.
By exploring the importance of communication, trust, and leadership in virtual team cooperation, this chapter has produced a preliminary research framework that could help to answer why human factors being investigated have influential effects on virtual teamwork. Firstly, the individual attitude in communication style and the impacts of mediated social interaction are discussed to understand the communication issues in the virtual team. Following that, the potential effects of interpersonal trust on virtual teamwork is well-explained by reviewing literature in both conventional and virtual team research. This chapter then introduces the role of leadership in the virtual team and describes the influence of leadership in virtual teamwork. Finally, a preliminary framework for this virtual team research is proposed by combining a simple virtual team I-P-O model, built in Chapter 2, with the three potential factors outlined above that may influence virtual teamwork. Based on this framework, the next chapter will develop a completed research framework and explain research methodology and method design for study.
Chapter 4: Research Methodology and Method

4.1 Introduction

This research aims to answer what human factors influence the effectiveness of team working in a cross-national environment and explanations for the influence of those factors. In Chapter 2, the role played by individual competencies that facilitate a virtual team’s knowledge sharing and contribute to a member’s satisfaction is emphasised, and research hypotheses indentifying the relationships between observed human factors in the virtual team’s I-P-O model are also developed. Chapter 3 has proposed other potential human factors that may affect virtual teamwork, such as communication, trust, and leadership. In order to investigate the proposed virtual teamwork model in the study, this research uses a mixed method approach, combining both quantitative and qualitative methods, to answer what are the influential human factors and the reasons behind their influences.

The purpose of this chapter is to introduce the research methodology and the method for the study. This chapter explains why a mixed research method is utilised in the study through discussions of research structure, justification for the paradigm and methodology, and applied research methods, in the first three sections. It then explains why quasi-experimental design is applied to replace traditional quantitative method surveys in existing virtual team members, and describes details of quasi-experimental design with the measures used. Further to the above, case study is introduced with clear descriptions of instrument development. Finally, difficulties in conducting research investigations are stressed.
4.2 Research Structure

One purpose of the research is to understand the effects of human factors on virtual teamwork by investigating the relationships between observed human factors. As discussed in Chapter 2, there are several relationships between those variables. Research Hypotheses 1) to 3), individual competencies, namely individual cultural intelligence, individual cultural openness, and self-efficacy, will respectively affect virtual team’s knowledge sharing willingness and behaviour. Hypothesis 4) there are correlations between individual competencies. Hypothesis 5) knowledge sharing willingness will positively influence knowledge sharing behaviour within a virtual team. Hypothesis 6) virtual team’s knowledge sharing will positively affect member’s satisfaction. Hypothesis 7) individual competencies have indirect effects on member’s satisfaction through a virtual team’s knowledge sharing.

Independent Variables

Independent variables are those factors assumed to affect dependent variables. Generally, the independent variables will be manipulated by researchers and researchers can investigate the influence of independent variables by observing the result of dependent variables (Kerlinger, 1986). This research emphasises the importance of individual competencies that influence a virtual team’s knowledge sharing and members’ satisfaction; thus, three variables, individual cultural intelligence, individual cultural openness, and self-efficacy, are regarded as independent variables in this study.

Intervening Variables

An intervening variable can explain the causal relationship between the independent and the dependent variables. The concept of intervening variables is different from
moderating variables because moderators only have contingent effect on the relationship between independent and dependent variables; moreover, moderators may either affect dependent variables or not (Rong, 2011). In this study, a virtual team’s knowledge sharing is regarded as a critical factor that directly impacts on members’ satisfaction. Therefore, knowledge sharing within a virtual team, including willingness and behaviour, is considered to be an intervening variable.

**Dependent Variables**

Dependent variables are those factors assumed to be impacted by independent variables; in other words, independent variables can be considered as causes while dependent variables can be assumed as effects (Chiou, 2000). Member’s satisfaction is the dependent variable in this research.

**Potential Moderators**

In addition to investigating the relationships between the variables outlined above, this research tries to explore why (or why not) those human factors can influence virtual teamwork. According to Baron and Kenny (1986), a moderator could be a qualitative or quantitative variables that influences the correlation between two variables, predictors and dependent variables. This research assumes that the positivity of the relation between dependent variable, virtual team’s knowledge sharing, and predictors, individual competencies, will be impacted by communication, trust, and leadership in the teamwork as outlined in the literature review in the Chapter 3. Thus, this study includes these three moderating variables in the research structure in order to develop a framework of a virtual team for investigation and discussion. Figure 4.1 shows that the research framework in the study requires both quantitative and qualitative investigation.
Figure 4.1: Research theoretical framework

**INPUT**
Individual Competencies
- Individual cultural intelligence
- Individual cultural openness
- Self-efficacy

**PROCESS**
Knowledge Sharing
- Knowledge sharing willingness
- Knowledge sharing behaviour

**OUTPUT**
Team Performance
- Team member’s satisfaction

**Potential Moderators**
- Communication style
- Trust
- Leadership

Hypotheses:
- H1a
- H1b
- H2a
- H2b
- H3a
- H3b
- H4a
- H4b
- H4c
- H5
- H6a
- H6b
- H7
4.3 Justification for the Paradigm and Methodology

4.3.1 Justification for the Paradigm

This study is classified as exploratory research because it attempts to discover general information to gain knowledge and understanding of the model of virtual teamwork in the cross-national environment. By using secondary research and qualitative approach, this study discusses the relationships between human factors and the effects of those factors on virtual teamwork. The ontological position in this research is that reality is a concrete structure, or, at least, the result of concrete processes. This positions the researcher’s epistemological stance as objectivism, and the theoretical perspective/philosophical stance is post-positivism.

Post-positivism reflects a deterministic philosophy that research problems studied need to investigate the influence of causes on the outcomes; thus, simplifying concepts into a discrete set of ideas to test, such as variables for constituting hypotheses, is commonly applied (Creswell, 2003). Post-positivism is distinct from positivism due to more critical realism. Positivists believe that the truth can be uncovered by science. By contrast, post-positivism assumes the theory is revisable and doubts the researcher’s ability to know reality with certainly (Phillips and Burbules, 2000). Post-positivists realise that the goal of science is getting it right about reality, although we can never explore the truth. Furthermore, all measurements and observations are fallible and may possess different types of error; thus, the importance of multiple measures is emphasised as Creswell (2003) mentioned, ‘developing numeric measures of observations and studying the behaviour of individuals become paramount for a post-positivist’ (Creswell, 2003, p.7).

Generally, post-positivism is usually associated with a quantitative approach; however,
some ‘post-positivist researchers often employ quantitative “deductive” methods
practices in their research, such as statistics, within a qualitative or multi-method
project’ (Hesse-Biber and Leavy, 2011, p.17). This research applies the mixed
methods of quantitative and qualitative strategies for collecting and analysing data
because it has been assumed that all methods have limitations and the biases of one
method could be neutralised by using another method. Consequently, this study
utilises the combination of traditional survey with field method interviews to collect
quantitative and qualitative data respectively.

4.3.2 Justification for the Methodology
This research applies mixed method in a concurrent procedure to provide a
comprehensive analysis of the research problem by converging quantitative and
qualitative data simultaneously. Both forms of quantitative and qualitative data are
collected at the same stage, and then, interpretations of the overall results are
produced by analysing integrated information. Further, different research questions
could be answered by nesting one form of data within another larger data collection
procedure (Creswell, 2003).

Quantitative Approach
Quantitative methods are usually used for testing hypotheses and generalising
knowledge by data collection (Hesse-Biber and Leavy, 2011). According to Creswell
(2003, p.13), ‘During the late 19th century and throughout the 20th century, strategies
of inquiry associated with quantitative research were those that invoked the
post-positivist perspectives.’ Quantitative strategies include experiments, such as true
experiments, quasi-experiments and single-subject experiments, correlational studies,
as well as structural equation models, and so on. As all measurements have different
types of error, this research tries to employ multiple measures to get a better understanding of the reality. The study emphasises using quasi-experimental design with surveys rather than using traditional quantitative methods in surveying existing virtual team members, because controlling different variables, including locations and individual competencies, is especially addressed. More details of using quasi-experimental design will be introduced later in this chapter.

Qualitative Approach

Applying the mixed approach, the combination of quantitative and qualitative methodologies, to derive knowledge about the problem is stressed to concentrate attention on the research problem (Tashakkori and Teddlie, 1998). Using all approaches to understand the problem is crucial. In qualitative research, five strategies are commonly used, ethnographies, grounded theory, case study, phenomenological research, and narrative research (Creswell, 2003). This study utilises case study as it can provide a better understanding of one or more individuals, such as an event, an activity, a process, and a program, by depth exploration (Flyvbjerg, 2011). The cases are bounded by time and activity, and collecting detailed information about individuals who are associated with a particular activity is the main data collection procedure in the study. This research conducts a quasi-experiment to investigate how virtual teams work in the cross-national environment; hence, case study is a suitable method to apply in this research because the data collected from experimental participants is from individuals who are associated with a particular activity, that is, the virtual team activity designed by quasi-experimental method.

4.4 Triangulation: Mixed Research Method

Triangulation is defined as ‘the combination of methodologies in the study of the
same phenomenon’ (Denzin, 1978, p.291), and it emphasises the concept that ‘qualitative and quantitative methods should be viewed as complementary rather than as rival camps’ (Jick, 1979, p.602). There are usually two different types of triangulation design, called ‘within-method’ (Denzin, 1978, p.301) and ‘between (across) methods’ (Denzin, 1978, p.302), and the most popular one used in organisational research is between methods design (Jick, 1979). Triangulation, which is the mixed method design combining both quantitative and qualitative data, can help develop a comprehensive understanding of the research problem (Creswell, 2012). The use of triangulation can obtain comparable data to interpret reliability and convergent validation; moreover, it can also provide a contextual description of the study as outline by Jick

_Beyond the analysis of overlapping variance, the use of multiple measures may also uncover some unique variance which otherwise may have been neglected by single methods. It is here that qualitative methods, in particular, can play an especially prominent role by eliciting data and suggesting conclusions to which other methods would be blind (Jick, 1979, p.603)._ 

The purpose of this study is to understand how virtual teams work in the cross-national environment by investigating the effects of human factors on teamwork. In addition to observed human factors, this research also tries to find other potential factors that could have important influences on virtual teamwork. As ‘triangulation may be used not only to examine the same phenomenon from multiple perspectives but also to enrich our understanding by allowing for new or deeper dimensions to emerge’ (Jick, 1979, pp.603-604), triangulation is an appropriate design for the study investigation. To avoid the same error or potential bias existing in the methods used, the research utilises triangulation that mixes quantitative and qualitative methods. For the quantitative approach, quasi-experimental design and surveys are utilised to
investigate the effects of observed human factors on virtual teamwork. Meanwhile, other factors can be explored in the qualitative findings by using multiple case studies in which individuals are interviewed to gain further insights. This study also collects data by observing virtual teamwork processes to help analyse the data more comprehensively.

4.5 Quasi-experimental Design

In order to understand virtual teamwork in a multi-national setting, observing and investigating how different virtual teams work in practice should be a recommended method to collect correct data for the study. The operational definition of a virtual team in this research is a team comprised of two or more people working together from different locations, especially different countries, and those team members communicate by utilising information technology to achieve a particular goal. To ensure appropriate data collection from virtual teams working in the context of cross-national boundaries, quasi-experimental design is a suitable method because participants can be assigned to different teams based on their locations, thus, they have to communicate with others through electronic media. A quasi-experiment is a scientific research method primarily used in the social sciences as the random assignment of subjects is sometimes impossible or impractical in the research design. According to Karayza & Keating (2007, p.2597), if there is ‘non-practicability of locating a large number of voluntarily participating units who would be randomly assigned to groups’, quasi-experimental design can be suggested as an appropriate method. Moreover, this research concentrates on the selection of virtual team members to investigate the causal relationship between individual competency factors and the virtual team’s knowledge sharing. Participants are selected to be in different groups based on individual differences, but not through random assignment.
Therefore, the use of quasi-experimental design is appropriate in this study because
the research tries to understand the effects of observed human factors by controlling
those factors in the real virtual teamwork.

4.5.1 Designing the Quasi-experiment

Factorial Experiment Design

A factorial design is usually used to measure all possible combinations across two or
more factors, each with different levels. The factorial design is suitable if there are
some interaction effects between factors in the experiment, therefore a factorial
experiment design is useful to study the effect of each factor on response variable and
the effects of interactions between factors on the response variable as well
(Montgomery, 2009). This research presumes that individual competencies, including
individual cultural intelligence, individual cultural openness and self-efficacy, have
their main influence on virtual team’s knowledge sharing respectively; besides, these
three factors interact with one another, and this kind of interaction can influence a
virtual team’s knowledge sharing. As outlined in Chapter 2, this research assumes that
people with a high level of individual competencies will perform better than people
with lesser abilities. As a result, this research utilises a 3×2 factorial design and there
are eight treatment combinations in total. Table 4.1 shows the experimental design
used in this study.
Table 4.1: 3×2 factorial experiment design

<table>
<thead>
<tr>
<th>Factors</th>
<th>Individual cultural intelligence</th>
<th>Individual cultural openness</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>High</td>
<td>AX</td>
<td>BX</td>
<td>CX</td>
</tr>
<tr>
<td>Low</td>
<td>AY</td>
<td>BY</td>
<td>CY</td>
</tr>
</tbody>
</table>

RUN

<table>
<thead>
<tr>
<th>Combinations (different types of virtual teams)</th>
<th>Cultural intelligence</th>
<th>Cultural openness</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 AXBXCX</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2 AXBXCY</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>3 AXBYCX</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>4 AXBYCY</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>5 AYBXCX</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>6 AYBXCY</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>7 AYBYCX</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>8 AYBYCY</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Controlled Variable in the Experiment**

A controlled variable is important for conducting an experiment because it can keep constant to prevent other potential factors influencing the effect of the independent variable on the dependent variable. In this experiment design, a controlled variable is academic performance, such as Great Point Average (GPA), because the experimental sample is drawn from university students and their academic performance usually represents student quality. Students must have upper average GPA to meet the basic requirement for participating in the quasi-experimental activity.

**Experimental Subjects and Sample**

Many researchers have discussed cultural difference issues in workgroups (Ayoko and Härtel, 2006, Shachaf, 2008); however, these studies primarily focus on a society-wide rather than an individual level. The purpose of this research is to discuss the influences of individual competencies on virtual teams that are working in the context of cross-national boundaries; thus, assigning virtual team members by
different geographic locations is the simplest way to guarantee that a virtual teams working in a cross-national environment. Numerous scholars, especially those studying in knowledge management and virtual environments, usually select participants from university students (Alge et al., 2003, Sarker et al., 2005, Chen et al., 2008, Liu et al., 2008a). Consequently, this research sample is drawn from Master’s level students studying in different countries, mostly in Asia Pacific countries, such as Australia, Indonesia, Taiwan, and Vietnam due to the convenience. However, the actual student population is likely to be far more diverse in terms of nationality, and could include students from China, India, Malaysia, and other countries in Asia, as the sample is drawn from the four countries’ universities which have overseas students.

**Sample Size**

As mentioned earlier, this study utilises a 3×2 factorial design that has eight treatment combinations in total; thus, there are eight different types of virtual teams developed based on characteristics of team member combination. This research categorises each type as one virtual team, so there are eight virtual teams; besides, four virtual teams are assigned members randomly for comparison with manipulated groups. Twelve virtual teams are in the quasi-experimental design. Every team is allocated five members in order to ensure equitable decision-making. Sixty-one students from different universities across four countries are selected as experimental sample and allocated to five-member teams based on the scores of individual competencies in the pre-test. The justification of the sample size for quantitative data analysis will also be discussed later in this chapter.

**Experimental Activity**

The experimental activity is an in-box decision exercise to apply theoretical content to
practical business contexts. Student participants are assigned to different virtual teams and the team task is to recommend applicants for the human resources manager position by evaluating 10 candidates’ curriculum vitae against the job description. Every virtual team is provided a website, RMIT blackboard, to enable them to work online so that team members can share their knowledge with others by using information technology, e.g., email, a discussion board and a chat room, and they can also submit required reports online.

4.5.2 The Procedures for Experimental Activity

To enable the study to occur, this research needs to identify students currently studying in master programs. In line with common practice is the style of research, the research investigators will initially approach course convenors agree to facilitate access to a volunteer sample of Master students. Course convenors identify student who are willing to participate and provide a list of potential participants that investigators can approach. The steps in recruiting potential participants are:

(1) The research investigators contact course convenors to request assistance in recruiting potential participants by formal emails because course convenors can facilitate access to a volunteer sample of Master students. If course convenors are willing to help, they invite students to participate in this research.

(2) Course convenors give information to students and identify students who may volunteer to participate in this study and provide lists of potential participants.

(3) The research investigators approach those potential participants and provide them “Plain Language Statement”, “consent form” and more information about experimental activity and research surveys.

(4) Students can indicate their willingness to consent to participating in this research by filling online consent form that input into SurveyMonkey.
(5) Once research investigators received the consent forms from students, research investigators contact participants for next steps.

Once students agree to participate in this research project, they are required to complete two online surveys, namely pre-test and post-test, and select the most qualified candidate for the HR manager position by working with other teammates from different locations. Every team will be given a virtual working environment which is RMIT Blackboard for its online working, such as information exchange, and online discussion. Thus, participants can completely work together in the virtual setting without face-to-face contact. The steps for conducting experimental activity are:

(1) Sixty-one university students who are studying in master’s level business degrees are selected as experimental samples. Prior to commencing the project, participants are surveyed by using demographic, individual cultural intelligence, individual cultural openness, and self-efficacy as well as knowledge sharing willingness for allocating participants to different virtual teams.

(2) Twelve virtual teams will be required to complete experimental activity which is the selection of HR manager and each team is given a virtual working environment which is RMIT Blackboard for the interaction between teammates.

(3) At the completion of the project, participants will be re-surveyed by using demographic, individual cultural intelligence, individual cultural openness, self-efficacy, knowledge sharing willingness and behaviour, and member satisfaction.

For more details of the experimental design and management, please refer to Appendix 1.
4.5.3 Instrument Development and Measures Utilised

In this research, some measurement items are adapted from existing literature while other items are developed based on the definition. However, none of the measurements has been tested in a virtual environment in previous studies. Developing new measures that can be applied to tests in a virtual setting is essential. Thus, this research conducted a pilot study to ensure the contextual relevance and logic of the questionnaires used.

*Individual Cultural Intelligence*

Individual cultural intelligence is assessed with items adapted from the Cultural Intelligence Centre (2005, quoted in Ang and Van Dyne, 2008b, p.389). Four attributes, metacognitive CQ, cognitive CQ, motivational CQ, and behavioural CQ, are examined. However, the measurement item behavioural CQ must be modified because the communication style in the virtual teamwork is different from conventional teams. The telecommunication tools utilised in virtual teams are online-phone, online chat room, online discussion board, and email; thus, communication between virtual team members could be both verbal and non-verbal. In this virtual team research, facial expressions, gestures, and posture rarely occur in team members’ communication behaviours due to the lack of face-to-face meetings. As a result, this research examines behavioural CQ by measuring individual behavioural changes and reactions in speaking and writing for the virtual teamwork. For individual cultural intelligence measurement items, please refer to Appendix 2.

It is necessary to ensure the quality of measurement items that can be applied in this virtual team study. Item analysis is a useful technique to improve of instrument design because it is a process that examines the quality of items/questions (Chiou, 2000).
This research checks the effectiveness of the items tested based on the item discrimination. Each respondent’s score on a particular measurement, for example, individual cultural intelligence, is first ranked in order, and then, the top 27% respondents and the bottom 27% respondents are separated into two groups, upper group and lower group, for the analysis (Wiersma and Jurs, 1990, Popham, 1981). Comparing the performance of two groups on each measurement item by using a T-test, the degree of discrimination of each item can be shown as the result should be significantly different (p< .05) (Chiou, 2000). This study eliminates items that could be ambiguous and misleading due to the lack of discrimination. From Table 4.2, three items, CQmc2, CQmot4, and CQbeh5, could be ambiguous because they do not have good item discrimination (p >.05). Thus, these three items must be eliminated for the individual cultural intelligence measurement.

<table>
<thead>
<tr>
<th>Item</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CQmc1</td>
<td>-3.355</td>
<td>23</td>
<td>.003</td>
</tr>
<tr>
<td>CQmc2</td>
<td>-1.174</td>
<td>23</td>
<td>.252</td>
</tr>
<tr>
<td>CQmc3</td>
<td>-3.115</td>
<td>23</td>
<td>.005</td>
</tr>
<tr>
<td>CQmc4</td>
<td>-5.216</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQcog1</td>
<td>-4.690</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQcog2</td>
<td>-5.907</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQcog3</td>
<td>-6.179</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQcog4</td>
<td>-7.354</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQcog5</td>
<td>-5.136</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQcog6</td>
<td>-6.315</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQmot1</td>
<td>-4.128</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQmot2</td>
<td>-3.595</td>
<td>23</td>
<td>.002</td>
</tr>
<tr>
<td>CQmot3</td>
<td>-4.360</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CQmot4</td>
<td>-1.653</td>
<td>23</td>
<td>.112</td>
</tr>
<tr>
<td>CQmot5</td>
<td>-3.969</td>
<td>23</td>
<td>.001</td>
</tr>
<tr>
<td>CQbeh2</td>
<td>-3.593</td>
<td>23</td>
<td>.002</td>
</tr>
<tr>
<td>CQbeh3</td>
<td>-4.016</td>
<td>23</td>
<td>.001</td>
</tr>
<tr>
<td>CQbeh4</td>
<td>-3.302</td>
<td>23</td>
<td>.003</td>
</tr>
<tr>
<td>CQbeh5</td>
<td>-1.571</td>
<td>23</td>
<td>.180</td>
</tr>
<tr>
<td>CQbeh6</td>
<td>-2.342</td>
<td>23</td>
<td>.028</td>
</tr>
</tbody>
</table>

Individual Cultural Openness

To investigate the personal cultural openness of virtual team members, this research
applies the concept of dissimilarity openness that is utilised to discuss the individual cultural openness in previous studies in teams/workgroups (Fujimoto et al., 2000, Fujimoto and Härtel, 2004). Individual cultural openness will be assessed by the questionnaire of dissimilarity openness measurement that was developed by Fujimoto (2000). All question items for measuring individual cultural openness can be seen in Appendix 2.

This study uses item analysis to ensure the quality of measurement items of individual cultural openness. Based on the result of item discrimination shown in Table 4.3 below, no item needs to be eliminated because all measurement items are significant discrimination (p<.05).

<table>
<thead>
<tr>
<th>Table 4.3: Item discrimination for individual CO questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-test for Equality of Means</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>

**Self-efficacy**

This study applies self-efficacy, which is the core variable of Bandura’s social cognitive theory, to investigate its influence on virtual teamwork. Some researchers have examined social cognitive theory to discuss knowledge transfer in a virtual team or community (Chiu et al., 2006, Staples and Webster, 2007). Moreover, a widely used scale of self-efficacy measurement has been developed to measure students’ motivational beliefs in Pintrich & De Groot’s (1990) research. This study modifies self-efficacy measurement items from Pintrich & De Groot’s (1990) motivated strategies for learning questionnaires (MSLQ) to assess virtual team members’
self-efficacy and measurement items, which can be seen in Appendix 2. By doing item discrimination, the result in Table 4.4 shows that no item needs to be eliminated in the self-efficacy measurement because every question is significant discrimination (p< .05).

Table 4.4: Item discrimination for SE questions

<table>
<thead>
<tr>
<th></th>
<th>t-test for Equality of Means</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE1</td>
<td>-9.433</td>
<td>35</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE2</td>
<td>-8.649</td>
<td>35</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE3</td>
<td>-8.302</td>
<td>35</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE4</td>
<td>-9.855</td>
<td>35</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE5</td>
<td>-8.779</td>
<td>35</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE6</td>
<td>-4.700</td>
<td>35</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Knowledge Sharing Willingness

Knowledge sharing willingness is defined as an individual’s attitude to share personal knowledge. According to Fishbein and Ajzen’s TRA, the relationships between attitude, intention, and behaviour have been proved (Fishbein and Ajzen, 1975). Bock & Kim (2002) and Lin (2007) have also proved the relationship in the knowledge-sharing context. From the definition in this study, knowledge sharing willingness includes personal attitude and intention to share knowledge, so this study utilises both concepts, attitude toward knowledge sharing and intention to share knowledge, to measure knowledge sharing willingness. Attitude toward knowledge sharing is defined ‘the degree of one’s positive feeling about sharing one’s knowledge’ (Bock and Kim, 2002, p.16), while intention to share knowledge is defined as ‘the degree to which one believes that one will engage in a knowledge sharing act’ (Bock and Kim, 2002, p.16). The measurement items, which can be seen in Appendix 2, for knowledge sharing willingness are modified from the previous research of Bock & Kim (2002), Lin (2007), and Taylor & Todd (1995). As can be seen in Table 4.5, all items are significant discrimination (p< .05) so the measurement
Knowledge Sharing Behaviour

Nonaka and Takeuchi’s SECI model is well-known in research about knowledge sharing; however, only two conversions of SECI model, externalisation and internalisation, are the focus of this research. Externalisation is articulating tacit knowledge into explicit knowledge and translating personal tacit knowledge into readily understandable forms (Nonaka and Konno, 1998, Nonaka et al., 2000). The techniques of expressing personal ideas, concepts, and images, such as in formal documents, manuals, and specifications, are crucial in the conversion of externalisation (Nonaka and Konno, 1998). Consequently, this research defines externalisation as individual tacit knowledge being translated to comprehensive forms which can be easily understood by others. On the other hand, ‘Internalisation is the process of embodying explicit knowledge into tacit knowledge’ (Nonaka et al., 2000, p.10). Individuals can obtain explicit knowledge, which is shared throughout an organisation, into personal tacit knowledge by training and exercises (Nonaka and Konno, 1998). Learning by doing is necessary in internalisation. As a result, internalisation in this study is defined to mean where people integrate new knowledge into their own tacit knowledge by absorbing translated knowledge. Based on the definitions of externalisation and internalisation in this research, measurement items

<table>
<thead>
<tr>
<th>Item</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKSW1</td>
<td>-6.709</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>AKSW2</td>
<td>-6.662</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>AKSW3</td>
<td>-10.536</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>AKSW4</td>
<td>-8.623</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>IKSW1</td>
<td>-4.404</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>IKSW2</td>
<td>-5.713</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>IKSW3</td>
<td>-4.947</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>IKSW4</td>
<td>-6.227</td>
<td>32</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
are modified from the previous research of Ju et al. (2006) and Choi & Lee (2002). The questionnaire on knowledge sharing behaviour can be found at Appendix 2.

Based on the result of item discrimination shown in Table 4.6, no item needs to be eliminated in the knowledge sharing behaviour measurement as they are significant discrimination ($p<.05$).

### Table 4.6: Item discrimination for KSB questions

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EKSB1</td>
<td>-5.010</td>
<td>21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>EKSB2</td>
<td>-6.982</td>
<td>21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>EKSB3</td>
<td>-2.688</td>
<td>21</td>
<td>.014</td>
</tr>
<tr>
<td>EKSB4</td>
<td>-6.203</td>
<td>21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>EKSB5</td>
<td>-6.143</td>
<td>21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>EKSB6</td>
<td>-6.140</td>
<td>21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>IKSB1</td>
<td>-2.120</td>
<td>21</td>
<td>.046</td>
</tr>
<tr>
<td>IKSB2</td>
<td>-3.373</td>
<td>21</td>
<td>.003</td>
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<tr>
<td>IKSB3</td>
<td>-3.380</td>
<td>21</td>
<td>.003</td>
</tr>
<tr>
<td>IKSB4</td>
<td>-2.879</td>
<td>21</td>
<td>.009</td>
</tr>
</tbody>
</table>

**Member’s Satisfaction**

The definition of member satisfaction in this study is an individual’s satisfaction level with the team cooperation; this study measures member satisfaction by utilising two concepts, satisfaction with the outcomes of cooperation and satisfaction with the process of cooperation. Satisfaction with the outcomes of cooperation is defined as an individual’s satisfaction level with the team performance, including task outcome, while satisfaction with the process of cooperation is defined as an individual’s satisfaction level with the relationship between team members in the cooperation process. Measurement items, which are contained in Appendix 2, are based on the definition and modified from the previous research of Gladstein (1984) and Smith et al. (1995).
This research uses item analysis for ensuring the quality of measurement items and finds that no item needs to be eliminated. Table 4.7 shows that every question has significant discrimination ($p<.05$).

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSO1</td>
<td>-7.743</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSO2</td>
<td>-8.124</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSO3</td>
<td>-7.009</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSO4</td>
<td>-4.722</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSP1</td>
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<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSP2</td>
<td>-4.827</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSP3</td>
<td>-4.306</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MSP4</td>
<td>-7.243</td>
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<td>&lt;.001</td>
</tr>
<tr>
<td>MSP5</td>
<td>-5.553</td>
<td>23</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**4.5.4 Quantitative Data Collection and Analysis**

**Data Collection**

This study utilises quasi-experimental design to collect quantitative data to examine the relationships between the human factors investigated, and the questionnaire surveys for data collection are conducted in two different stages during the experimental period. Prior to commencing the project, individual cultural intelligence, individual cultural openness, and self-efficacy, as well as knowledge sharing willingness, are measured. Participants in the experimental are allocated to different teams based on the scores of individual competencies. At the completion of the project, participants are re-surveyed on individual cultural intelligence, individual cultural openness, self-efficacy, and knowledge sharing willingness, as well as knowledge sharing behaviour and member’s satisfaction. The surveys are undertaken using SurveyMonkey, which is a tool frequently used for research. All questionnaire items, both pre-test and post-test, are input into the SurveyMonkey website. Participants are given a unique identifier to access SurveyMonkey so they can answer
the questionnaires online by simply clicking on a button. The surveys taken at these
different points in time can allow this research to find different results by comparing
the two stages of measurement.

**Data Analysis and Justification for Sample Size**

This study investigates research hypotheses by using multivariate analysis with SPSS,
such as correlation, three-way ANOVA, simple regression, and multiple regressions.
Firstly, the reliability and validity of the measurements used is examined; also,
demographic data can be tested using a t-test and one-way ANOVA. Then, the effort
of the quasi-experimental design will be investigated by using three-way ANOVA.
Finally, to test the effects of the independent and intervening variables on dependent
variables, as proposed in the I-P-O virtual team model, path analysis could be a
suitable method. Path analysis is frequently used for investigating the directed
dependencies among a set of variables and it focuses on causality of multiple
regression (Chiou, 2000). Path analysis is similar to multiple regression but the
techniques allow researchers to easily test theoretical propositions about cause and
effect as a whole model. However, conducting an effective path analysis by the use of
structure equation modelling (SEM) requires a large research sample that should be
not less than 100 cases (Loehlin, 2004). In this study, the sample size is 61
experimental participants, so SEM is not appropriate to be applied for this study. This
research, therefore, utilises multiple regression by using SPSS to do the path analysis
because multiple regression requires a lesser sample size.

According to Cohen and Cohen (1983), sample size for multiple regression can be
calculated using four parameters, alpha (\(\alpha\)), power (1-\(\beta\)), the number of independent
variables and effect size. With an alpha (\(\alpha\)) of 0.05, five independent variables, a
moderate effect size of R=0.5 and statistical power level of 0.8, this study would need a minimum sample of 45, so a sample of 61 experimental participants is an acceptable size with which to do multiple regression. Chapter 5 will explain quantitative data analysis in more detail.

4.6 Case Study

In addition to the use of quasi-experimental design, another research strategy, case study, is also utilised in this study because the researcher’s theoretical perspective is post-positivism, which emphasises the importance of applying multiple strategies and measures for getting to know reality. Although this research is mainly classified as exploratory research, it can be seen as a combination of exploratory and explanatory because the purpose of this study is to uncover new knowledge about how virtual teams work in a cross-national environment, and investigates relationships among different human factors by answering two research questions that contain ‘what’ and ‘why’ questions. According to Yin (2003, p.6), ‘how and why questions are more explanatory and likely to lead to the use of case studies, histories, and experiments as the preferred research strategies’.

‘Case study is an approach that focuses one’s attention during learning, construction, discovery, or problem solving’ (VanWynsberghe and Khan, 2007, p.81) so it can be employed to all disciplines requiring exemplars, such as education, management studies, organisational studies, and sociology (Hesse-Biber and Leavy, 2011). Case study should be defined as a research strategy not a data collection tactic (Graebner and Eisenhardt, 2004, Yin, 2003) because it is not a methodological decision but a decision about what is to be studied (Stake, 1998). ‘A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context,
especially when the boundaries between phenomenon and context are not clearly
evident’ (Yin, 2003, p.13). Another explanation of case study is stated by Simons

*Case study is an in-depth exploration from multiple perspectives of the
complexity and uniqueness of a particular project, policy, institution,
programme, or system in a ‘real life’ context. It is research-based, inclusive of
different methods and is evidence-led. The primary purpose is to generate
in-depth understanding of a specific topic..., programme, policy, institution or
system to generate knowledge and/or inform policy development, professional
practice and civil or community action (Simons, 2009, p.21).*

The advantage of the case study approach is that research can obtain an holistic
understanding of an issue within its social context (Hesse-Biber and Leavy, 2011).
Case study research usually investigates one, or a few, case(s) in order to ‘build
understanding by addressing research questions and triangulating “thick descriptions”
with interpretations of those descriptions in an ongoing interactive process’
(Hesse-Biber and Leavy, 2011, p.256). Thus, a case study research may be a simple
(single case) or complex (multiple cases) study and it can include any mix of
quantitative and qualitative evidence based on the development of the theoretical
propositions.

Generally, data collection often occurs before building theories or formulating
research questions in an exploratory case study, whereas the data collection is trying
to explain how things happened in the explanatory case study. This research is
basically an exploratory research project, providing information to obtain knowledge
about the model of virtual teamwork, and utilises surveys together with the
quasi-experimental design to deal with phenomenon and context. However,
investigating via surveys alone has its own limitations, for example, ‘constant
struggles to limit the number of variables to be analysed to fall safety within the number of respondents that can be surveyed’ (Yin, 2003, p.13). Consequently, this study also applies qualitative method, such as interviews and observations, for a source of case study evidence to cover contextual conditions that might be highly related with phenomenon of the study.

4.6.1 Designing Case Study

Case Study Design

Four types of case study design are commonly used in previous research. They are holistic single-case design, embedded single-case design, holistic multiple-case design, and embedded multiple-case design (Yin, 2003). The first type of case study is the holistic single-case design which discusses one case containing a single unit of analysis only; while the second type is the embedded single-case design which means one case including multiple units of analysis. By contrast, the third and fourth types of case study design discuss multiple cases. The third type, holistic multiple-case design, discusses many cases but every case contains a single unit of analysis; while, the fourth type of case study is the embedded multiple-case design, which includes many cases and each case contains multiple units of analysis.

This research utilises the fourth type of case design, embedded multiple-case design, because this study intends to enrich information through the in-depth investigation of individuals. The purpose of using case study is to try to find an interesting, unusual or particularly revealing set of circumstances which is different from the survey results. Hence, in this the study, university students from different countries are selected as individual research units for analysis, with each individual being investigated in-depth. ‘Multiple-case rationale can derive from the prior hypothesising of different types of
conditions and the desire to have subgroups of cases covering each type’ (Yin, 2003, p.52). The research investigation contains students from universities in four countries, which can be regarded as the site selection, so multiple-case design is appropriate for this quasi-experimental study. Moreover, each case involves two units of analysis, as two individuals are selected from each country for the analysis and, therefore, multiple holistic case design is not suitable. Therefore, this research applies embedded multiple-cases design for case study.

**Case Selection**

It is important to properly select cases for case study research because the selected cases must be a representative sample of the population. ‘In the beginning (of case study research), phenomena are given, (and then) the cases are opportunities to study the phenomena’ (Stake, 1998, p.100). The phenomena in this research is virtual teams working in the context of cross-national boundaries; this study tries to improve the understanding of virtual teamwork in the cross-national environment, in addition to what we have investigated of individual competencies. There may be not a small population of hypothetical cases but few of them are accessible cases for researcher. Thus, it is essential that experimental design is such that the virtual team working environment subjects are representative, and therefore, the research cases should be selected from the experimental groups. As mentioned, the research sample is drawn from Master’s level students studying in four different countries, Australia, Indonesia, Taiwan, and Vietnam, to ensure that participants are from multiple national backgrounds, hence, cases have been selected from these four different countries. The researcher travelled overseas to each of the four countries mentioned to recruit quasi-experimental participants, and also to collect qualitative data via face-to-face interviews.
**Sampling within the Case**

There are usually two phases in technical sampling in case study research. In the first stage, it is necessary to select the cases, and the second stage involves sampling within the case. As described, case selection in this case study is within four countries; Australia, Indonesia, Taiwan, and Vietnam. The data collected from the sites selected addresses how members’ multi-national backgrounds influence the virtual team’s cooperation. The second level of sampling within the case is that individuals have participated in the experimental project, virtual team activity, or not. Two categories of individuals are selected for interview in each case study. One individual who has participated in the virtual team activity, and another individual who has not participated in the virtual team activity, are drawn as a unit of analysis from each country. Interviews are conducted with two people in each case/site and eight individuals were interviewed from each of four countries. Table 4.8 shows the case section and sampling within the case.

**Table 4.8: Case section and sampling within the case**

<table>
<thead>
<tr>
<th>Case</th>
<th>Site Selection</th>
<th>Institution</th>
<th>Unit of Analysis</th>
<th>Interviewee’s Characteristic</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Australia</td>
<td>RMIT University Melbourne campus</td>
<td>Student Australia 01</td>
<td>Virtual team participant</td>
<td>AU01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Student Australia 02</td>
<td>Non-virtual team participant</td>
<td>AU02</td>
</tr>
<tr>
<td>2</td>
<td>Indonesia</td>
<td>Gadjah Mada University</td>
<td>Student Indonesia 01</td>
<td>Virtual team participant</td>
<td>ID01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Student Indonesia 02</td>
<td>Non-virtual team participant</td>
<td>ID02</td>
</tr>
<tr>
<td>3</td>
<td>Taiwan</td>
<td>Da-Yeh University</td>
<td>Student Taiwan 01</td>
<td>Virtual team participant</td>
<td>TW01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Student Taiwan 02</td>
<td>Non-virtual team participant</td>
<td>TW02</td>
</tr>
<tr>
<td>4</td>
<td>Vietnam</td>
<td>RMIT International University Vietnam</td>
<td>Student Vietnam 01</td>
<td>Non-virtual team participant</td>
<td>VN01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Student Vietnam 02</td>
<td>Virtual team participant</td>
<td>VN02</td>
</tr>
</tbody>
</table>
4.6.2 Profile of Case Study Institutions

This research selects cases from four different countries and two case study respondents are sampled separately within each case. Four institutions in four countries, Australia, Indonesia, Taiwan, and Vietnam, are selected as cases in this research.

**Australia (RMIT Melbourne City Campus)**

The Royal Melbourne Institute of Technology (RMIT) University, is one of the leading educational institutions in Australia. The university is one of the Australia’s largest original institutions which produces employable graduates annually. There are more than 70,000 students studying at RMIT University throughout the world, including at RMIT campuses in Melbourne, in Vietnam, online, and at partner institutions, such as Singapore, Hong Kong, mainland China, Malaysia, India and Europe. RMIT University has three main campuses around Melbourne, which is the capital city of the State of Victoria in Australia. While Melbourne has almost four million residents from more than 140 nations, 41 per cent of whom were born overseas, RMIT’s Melbourne campuses student population of 50,000 includes around 15,000 international students. This information was obtained from RMIT University’s official website (RMIT University, 2012).

**Indonesia (Gadjah Mada University)**

Gadjah Mada University was founded on 19 December, 1949. The university is the oldest and largest state university in Indonesia and it is located in The Special Region of Yogyakarta. Yogyakarta, which has been known as the centre of Javanese culture as well as the centre of learning, is one of the smallest provinces in Indonesia having
3,200,000 residents, 511,000 of whom inhabit the city of Yogyakarta. In December 2000, Gadjah Mada University was given the new status as a state-owned legal entity, and it currently has 18 faculties, 73 undergraduate study programs, 28 diploma study programs, and a graduate program of 62 study programs ranging from Social Sciences to Engineering. The student population in Gadjah Mada University is approximately 55,000, including 650 foreign students. The information above was obtained from Gadjah Mada University’s official website (Universitas Gadjah Mada, 2012).

Taiwan (Da-Yeh University)

Da-Yeh University is a private university in Changhua County, Taiwan and it was established in March 1990. The university consists of five colleges, including the College of Engineering, the College of Design and Arts, the College of Management, the College of Biotechnology and Bioresources, and the College of Foreign Languages. Da-Yeh University is a new educational institution in Taiwan and intends to explore new fields of academic studies. By using Video On Demand (VOD) to construct a learning network system and working in relationships with international partners, Da-Yeh University has tried to aim at internationalising the university to improve academic cooperation with other universities. Currently, the University’s student population is around 10,000, less than 1% per cent of whom are from overseas. This information was obtained from Da-Yeh University’s official website (Da-Yeh University, 2012).

Vietnam (RMIT Ho Chi Minh City Campus in Vietnam)

RMIT International University Vietnam is Vietnam’s first and only fully foreign-owned university, delivering internationally recognised degrees and Australian degrees, from campuses in Hanoi and Ho Chi Minh City. RMIT Vietnam
has three centres, including commerce and management, communication and design, and technology. It has grown rapidly since it commenced operations in 2001 in Ho Chi Minh City and 2004 in Hanoi. Currently, the total student population on both campuses in RMIT Vietnam is around 5,000 and approximately 10 per cent of students are from other countries, such as Australia, Algeria, Britain, China, Denmark, France, Germany, Korea, Libya, Malaysia, Norway, Philippines, Russia, Singapore, Taiwan, and the USA. The information above was obtained from RMIT University Vietnam’s official website (RMIT University Vietnam, 2012).

4.6.3 Source of Evidence
There are six major methods that are frequently utilised for collecting data in research involving case study methodology; documentation, archival records, interviews, direct observation, participant-observation, and physical artefacts (Yin, 2003, Hesse-Biber and Leavy, 2011). The case studies in this research use three sources of data gathering because ‘no single source has a complete advantage over all the others’ (Yin, 2003, p.85), and using as many different sources of data gathering as possible benefits the quality of the case study.

Participant-observation and Documentation
The research investigator participated in all virtual teams as a team member in the experiment project. The researcher was not a passive observer, and was a participant-observer. Participating in the actual experimental project allowed the researcher to observe the interaction between virtual team members, which is a better method of understanding the virtual team’s work style in reality and enabled researcher to have comprehensive insights to be able to explain the data. The researcher monitored and recorded daily virtual teamwork during the experimental
period, and, therefore, all internal records can be analysed for every virtual team activity. Moreover, virtual teams were required to submit regular progress reports for the teamwork and a final report. Those documents could also be analysed to get better understanding of team cooperation.

**Interviews**

In order to find unusual and interesting information that differ from the survey results, this research used structured interviews with individuals selected from each case. The researcher required course convenors’ assistance to facilitate access to a volunteer sample of Masters students in order to conduct the in-depth interviews, as this research needed to identify students currently studying in Masters programs. Course convenors helped the researcher to identify students who are willing to participate in the interviews. Firstly, the list of questions was sent to potential interviewees. After obtaining respondents’ agreement, the researcher approached those potential participants and scheduled face-to-face interviews.

**4.6.4 Instruments Development and Interviews Conducted**

*Instruments Development*

The data collected in this case study was gathered mainly using structured interviews. Data is gathered by structured interviews with individual respondents from the case studies. For interviewees’ preparation and understanding, a list of interview questions, which focuses on topics on the standard questions list, is provided to interviewees in advance of conducting each interview.

The interview questions are developed from the definitions of existing studies. The main sections of these interview questions are institution profiles, interviewee’s
background and experience, individual cultural intelligence, individual cultural openness, self-efficacy, and potential inferential factors on virtual team cooperation. However, the interview questions for virtual team participants in the experiment conducted by the researcher were quite different from questions for non-virtual team participants. The focus of the interview questions for virtual team participants concentrates on finding potential factors that may affect virtual team teamwork, such as the team interaction, whereas a list of questions for non-virtual team participants intends to compare the differences between virtual team experience and conventional team experience. For more details and the complete list of interview questions that are used in this research, please refer to Appendix 3.

**Interview Conducted**

Face-to-face interviews are conducted. As this study is in cross-national boundaries, face-to-face interviews conducted in four different countries are not easy owing to the lack of financial support. It is really a challenge for the researcher to travel overseas frequently to conduct face-to-face interviews in four different countries. Thus, there is only a small number of interviewees in the study. Interviews are conducted for approximately one hour to an hour and a half. One interview took longer because the interviewee occasionally needed help from a language translator to understand and answer questions.

Most interviews are being tape recorded because recording is the best way to keep and recheck data for interview data collection. There may be an argument that tape recording makes respondents feel uncomfortable; however, this research diminished this kind of ethical issue by obtaining interviewees’ consent to tape record the interviews. The researcher recorded the interview only if respondents agreed with it.
4.7 Research Constraints

This research is designed to explore the influences of human factors on cross-national virtual teamwork by the use of quasi-experimental design that can control all investigated variables to observe their effects and ensure virtual teams work in the cross-national environment. Manipulating experimental groups according to a number of criteria, such as different national backgrounds and the individual abilities of virtual team members, can help this research to concentrate on the impacts of particular human factors. However, it also means that the study needs to have an awareness of fewer objectives than would exist in the real virtual teamwork context.

This study is in the context of cross-national boundaries, which includes four different countries. Owing to the limitations of time and financial resources, the researcher was not fully in control of these external contexts.

Recruiting experimental participants from universities in four different countries is not easy since it is beyond the researcher’s ability and relies heavily on the support of many relevant course coordinators. In addition to recruitment, it is more challenging for the researcher to control the processes of different virtual teamwork due to the long distance and the lack of physical contacts. Problems could occur in team cooperation and it may cause some unexpected impacts on virtual teamwork. Moreover, conducting face-to-face interviews overseas without any supporting funding is another barrier to doing the research.

Finally, language could be a problem for data collection in interviews because most of the interviewees are not native English speakers. Some interviewees cannot express their opinions well and it could create some problems in communication, such as
misunderstanding of messages. The researcher tries to overcome this problem by
taking a much longer time to repeat and cross-check data in such interviews and the
researcher sometimes must use local language or seek someone’s help to translate
during the interviews.

4.8 Summary
This chapter discussed the research methodology and applied mixed research methods
in detail. Firstly, the reason for the use of a mixed research method in this study is
explained by discussing the research structure and justification of the paradigm. Then,
the importance of using triangulation that combines quantitative and qualitative
approaches is introduced. After that, the detailed quasi-experimental design and case
study design are described in two separate sections that contain the development of
instruments and data collection procedures. Data analysis for both quantitative and
qualitative data gathering is simply mentioned in this chapter and it will be explained
in more detail in Chapters 5 and 6 respectively. Finally, research constraints are also
discussed at the end of this chapter.
Chapter 5: Quantitative Analysis

5.1 Introduction

The virtual team I-P-O model, built in Chapter 2, is developed based on the gaps in current studies of conventional and virtual teamwork. Investigating human factors of virtual teamwork is emphasised in the research so that individual cultural intelligence, individual cultural openness, and self-efficacy have been stressed as three crucial factors that influence the virtual team’s knowledge sharing and member’s satisfaction. Surveys and the quasi-experimental design are developed in Chapter 4 for research investigation. This chapter presents the result of collected data from experimental participants by using surveys in different stages, pre-test and post-test, to examine the relationship between observed human factors.

The chapter firstly tests the reliability and the construct validity of measurements, then states demographic data analysis. Further, it examines the validity of quasi-experimental design and displays the result of research hypotheses by using multivariate analysis. An outline of the investigation of the hypotheses can be seen in Table 5.1. The results from this research have shown that the hypotheses cannot be supported by quantitative study alone.

<table>
<thead>
<tr>
<th>Hypothesis 1</th>
<th>Partly Support</th>
<th>H1 (a)</th>
<th>Partly support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>H1 (b)</td>
<td>Not support</td>
</tr>
<tr>
<td>Hypothesis 2</td>
<td>Partly Support</td>
<td>H2 (a)</td>
<td>Partly support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H2 (b)</td>
<td>Not support</td>
</tr>
<tr>
<td>Hypothesis 3</td>
<td>Partly Support</td>
<td>H3 (a)</td>
<td>Support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H3 (b)</td>
<td>Not support</td>
</tr>
<tr>
<td>Hypothesis 4</td>
<td>Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothesis 5</td>
<td>Not Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothesis 6</td>
<td>Partly Support</td>
<td>H6 (a)</td>
<td>Not support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H6 (b)</td>
<td>Support</td>
</tr>
<tr>
<td>Hypothesis 7</td>
<td>Not Support</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2 Reliability and Validity

According to Chiou (2000) and Wu (2000), every measurement device utilised in the research investigation must possess a certain quality because researchers need to obtain accurate information from those assessments, thus, it is necessary to ensure that the surveys have the right qualities to do research. Two commonly used technical methods to test the quality of the measurement are reliability and validity. Reliability is the degree of consistency between measures that shows the survey is stable, dependable, and trustworthy when it is used to measure the same thing at different times (Worthen et al., 1993); whereas, validity is the degree of truthfulness of a response and that a survey measures what it claims to measure (Worthen et al., 1993). To test and improve the quality of measurement, both reliability and validity must be assessed in order to reach a scientifically rigorous approach (Chiou, 2000).

5.2.1 Reliability

This research examines the reliability of measurements by using internal consistency reliability, as the purpose of internal consistency reliability is to assess the consistency of results across items within a test. Cronbach’s alpha, a generalisation of an earlier form of estimating internal consistency, is the most frequently used method for testing internal consistency reliability. According to Wu (2000), the number of Cronbach’s alpha ranges from 0 to 1, and values closer to 1 indicate higher reliability. Ideally, the acceptable reliability is 0.7 or greater (Hair et al., 1998).

Table 5.2 and Table 5.3 show that the reliability of all measurements utilised in both the pre-test and post-test are acceptable because most of them are higher than 0.8. Only two measures that test for meta-cognitive CQ and motivational CQ are lower than 0.8, but they are still greater than the acceptable reliability of 0.7.
Table 5.2: Cronbach’s alpha for internal consistency reliability (pre-test)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Variables</th>
<th>Question items</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Intelligence (CQ)</td>
<td>Meta- Cognitive CQ</td>
<td>5</td>
<td>0.794</td>
</tr>
<tr>
<td></td>
<td>Cognitive CQ</td>
<td>4</td>
<td>0.822</td>
</tr>
<tr>
<td></td>
<td>Motivational CQ</td>
<td>3</td>
<td>0.715</td>
</tr>
<tr>
<td></td>
<td>Behavioural CQ</td>
<td>5</td>
<td>0.808</td>
</tr>
<tr>
<td>Cultural Openness</td>
<td>Cultural openness</td>
<td>5</td>
<td>0.876</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Self-efficacy</td>
<td>6</td>
<td>0.905</td>
</tr>
<tr>
<td>Knowledge Sharing</td>
<td>Attitude toward knowledge sharing</td>
<td>4</td>
<td>0.884</td>
</tr>
<tr>
<td>Willingness</td>
<td>Intention to share Knowledge</td>
<td>4</td>
<td>0.854</td>
</tr>
</tbody>
</table>

Table 5.3: Cronbach’s alpha for internal consistency reliability (post-test)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Variables</th>
<th>Question items</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Intelligence (CQ)</td>
<td>Meta- Cognitive CQ</td>
<td>5</td>
<td>0.877</td>
</tr>
<tr>
<td></td>
<td>Cognitive CQ</td>
<td>4</td>
<td>0.816</td>
</tr>
<tr>
<td></td>
<td>Motivational CQ</td>
<td>3</td>
<td>0.759</td>
</tr>
<tr>
<td></td>
<td>Behavioural CQ</td>
<td>5</td>
<td>0.866</td>
</tr>
<tr>
<td>Cultural Openness</td>
<td>Cultural openness</td>
<td>5</td>
<td>0.858</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Self-efficacy</td>
<td>6</td>
<td>0.913</td>
</tr>
<tr>
<td>Knowledge Sharing</td>
<td>Attitude toward knowledge sharing</td>
<td>4</td>
<td>0.934</td>
</tr>
<tr>
<td>Willingness</td>
<td>Intention to share Knowledge</td>
<td>4</td>
<td>0.906</td>
</tr>
<tr>
<td>Knowledge Sharing</td>
<td>Externalisation</td>
<td>6</td>
<td>0.878</td>
</tr>
<tr>
<td>Behaviour</td>
<td>Internalisation</td>
<td>4</td>
<td>0.874</td>
</tr>
<tr>
<td>Member</td>
<td>Satisfaction with outcomes of cooperation</td>
<td>4</td>
<td>0.941</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Satisfaction with processes of cooperation</td>
<td>5</td>
<td>0.896</td>
</tr>
</tbody>
</table>

5.2.2 Construct Validity

Construct validity seeks agreement between a theoretical concept and a specific measuring device or procedure. Carmines and Zeller (1979) stated that three steps should be taken to examine the construct validity. First, specifying the theoretical relationship is necessary. Then, examining the empirical relationships between measuring devices for theoretical concepts should be stressed. Finally, ‘the empirical evidence must be interpreted in terms of how it clarifies the construct validity of the particular measure being tested’ (Carmines and Zeller, 1979, p.23). As mentioned above, the researcher assumes that the construct validity can be measured by examining the relationship between a specific measurement and theoretical variable because they should highly correlate with each other. Factor analysis is a common
technique to investigate the underlying constructs in a measurement used by examining the pattern of relationships among observed variables (Chiou, 2000). By using factor analysis, the result shows that all measurements used have good construct validity because there is an association between theoretical concept and a specific measuring device.

**Cultural Intelligence**

Examining the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett’s test are necessary to do factor analysis because they can determine the suitability of applying factor analysis (Chiou, 2000). ‘A KMO value of 0.5 is poor, 0.6 is acceptable and a value closer to 1 is better’ and a ‘p value <0.05 in the Bartlett’s test indicates that it is appropriate to continue with the factor analysis’ (Dwivedi, 2008, pp.120-121). With a KMO value of .721 at the significance level of p<.001, the result of KMO and Bartlett’s test shows that the data set of cultural intelligence is suitable for doing factor analysis.

| Table 5.4: KMO and Bartlett’s test and Total Variance Explained (for CQ) |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| KMO and Bartlett’s test and Total Variance Explained (for CQ) | Factor | Extraction Sums of Squared Loadings | Total | % of Variance | Cumulative % |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Kaiser-Meyer-Olkin measure of sampling adequacy | .721 | Factor | Extraction Sums of Squared Loadings | Total | % of Variance | Cumulative % |
| Bartlett’s Test of Sphericity | Approx. Chi-Square 412.293 Df 136 Sig. <.001 | 1 | 6.225 | 36.616 | 36.616 |
| | | 2 | 2.349 | 13.819 | 50.435 |
| | | 3 | 1.819 | 10.700 | 61.135 |
| | | 4 | 1.072 | 6.308 | 67.443 |

After running factor analysis using SPSS, only the first four factors are retained as their eigenvalues are greater than 1 (the values are 6.225, 2.349, 1.819 and 1.072 respectively) and the cumulative percentage of variance accounted for by the first four factors together is 67.443%. Four main components, meta-cognitive CQ, cognitive
CQ, motivational CQ and behavioural CQ, were identified that can be extracted by using the principal component analysis. The result is consistent with the literature; therefore, the measurement of cultural intelligence has construct validity.

Table 5.5: Pattern Matrix (for CQ)

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cognitive</td>
<td>motivational</td>
<td>meta-cognitive</td>
<td>behavioural</td>
</tr>
<tr>
<td>CQcog5</td>
<td>.849</td>
<td>.130</td>
<td>.036</td>
<td>-.011</td>
</tr>
<tr>
<td>CQcog3</td>
<td>.843</td>
<td>.005</td>
<td>.253</td>
<td>-.054</td>
</tr>
<tr>
<td>CQcog1</td>
<td>.735</td>
<td>.381</td>
<td>-.164</td>
<td>.235</td>
</tr>
<tr>
<td>CQcog4</td>
<td>.703</td>
<td>.137</td>
<td>.306</td>
<td>.209</td>
</tr>
<tr>
<td>CQmot2</td>
<td>.203</td>
<td>.862</td>
<td>.065</td>
<td>-.058</td>
</tr>
<tr>
<td>CQmot3</td>
<td>.307</td>
<td>.701</td>
<td>.157</td>
<td>-.062</td>
</tr>
<tr>
<td>CQmot1</td>
<td>.037</td>
<td>.619</td>
<td>.174</td>
<td>.248</td>
</tr>
<tr>
<td>CQmc4</td>
<td>.245</td>
<td>-.006</td>
<td>.746</td>
<td>.185</td>
</tr>
<tr>
<td>CQmc1</td>
<td>.014</td>
<td>.435</td>
<td>.679</td>
<td>.184</td>
</tr>
<tr>
<td>CQmot5</td>
<td>.067</td>
<td>.266</td>
<td>.648</td>
<td>.409</td>
</tr>
<tr>
<td>CQmc3</td>
<td>-.037</td>
<td>.577</td>
<td>.611</td>
<td>.042</td>
</tr>
<tr>
<td>CQcog6</td>
<td>.310</td>
<td>.314</td>
<td>.512</td>
<td>.271</td>
</tr>
<tr>
<td>CQbeh3</td>
<td>.047</td>
<td>-.140</td>
<td>.146</td>
<td>.816</td>
</tr>
<tr>
<td>CQbeh2</td>
<td>-.082</td>
<td>.227</td>
<td>.283</td>
<td>.784</td>
</tr>
<tr>
<td>CQcog2</td>
<td>.378</td>
<td>.357</td>
<td>.084</td>
<td>.595</td>
</tr>
<tr>
<td>CQbeh4</td>
<td>.169</td>
<td>-.227</td>
<td>.525</td>
<td>.581</td>
</tr>
<tr>
<td>CQbeh6</td>
<td>.157</td>
<td>.477</td>
<td>.327</td>
<td>.512</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a Rotation converged in 7 iterations.

**Cultural Openness**

The result of KMO and Bartlett’s test shows that the data set of cultural openness is suitable to do factor analysis; a value of KMO of .859 (>0.6) at the significance level of p<.001. Only first factor is retained (eigenvalues = 3.393 >1) and the first factor accounts for 67.865% of the total variance.
Table 5.6: KMO and Bartlett’s test and Total Variance Explained (for CO)

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin measure of sampling adequacy</th>
<th>Bartlett’s Test of Sphericity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. Ch-Square</td>
<td>143.469</td>
</tr>
<tr>
<td>Df</td>
<td>10</td>
</tr>
<tr>
<td>Sig.</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Factor Extraction Sums of Squared Loadings</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>-------</td>
<td>---------------</td>
</tr>
<tr>
<td>1</td>
<td>3.393</td>
</tr>
</tbody>
</table>

One component, cultural openness, was extracted using the principal component analysis. The result is consistent with the literature; therefore, the measurement has construct validity.

Table 5.7: Component Matrix (for CO)

<table>
<thead>
<tr>
<th>component</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

Self-efficacy

The result of KMO and Bartlett’s test shows that the data set of self-efficacy is suitable for doing factor analysis; a value of KMO of .858 (>0.6) at the significance level of p<.001. After running factor analysis using SPSS, only the first factor is retained (eigenvalue = 4.122 >1) and the cumulative percentage of variance accounted for by the current factor is 68.692%. One component, self-efficacy, was extracted using the principal component analysis. The result is consistent with the literature; therefore, the measurement of self-efficacy has construct validity.
Table 5.8: KMO and Bartlett’s test and Total Variance Explained (for SE)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>4.122</td>
</tr>
</tbody>
</table>

Kaiser-Meyer-Olkin measure of sampling adequacy: .858
Bartlett’s Test of Sphericity: Approx. Chi-Square 219.574, Df 15, Sig. <.001

Table 5.9: Component Matrix (for SE)

<table>
<thead>
<tr>
<th>component</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE4</td>
<td>.893</td>
</tr>
<tr>
<td>SE5</td>
<td>.874</td>
</tr>
<tr>
<td>SE1</td>
<td>.867</td>
</tr>
<tr>
<td>SE3</td>
<td>.862</td>
</tr>
<tr>
<td>SE2</td>
<td>.860</td>
</tr>
<tr>
<td>SE6</td>
<td>.571</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

Knowledge Sharing Willingness

The result of KMO and Bartlett’s test shows that the data set of knowledge sharing willingness is suitable for doing factor analysis; a value of KMO of .874 (>0.6) at the significance level of p<.001.

Table 5.10: KMO and Bartlett’s test and Total Variance Explained (for KSW)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>4.985</td>
</tr>
<tr>
<td>2</td>
<td>1.009</td>
</tr>
</tbody>
</table>

Kaiser-Meyer-Olkin measure of sampling adequacy: .874
Bartlett’s Test of Sphericity: Approx. Chi-Square 287.132, Df 28, Sig. <.001

After running factor analysis using SPSS, only the first two factors are retained as their eigenvalues are greater than 1 (the values are 4.985 and 1.009 respectively) and the cumulative percentage of variance accounted for by the first two factors together...
is 73.806%. The two main components, attitude toward knowledge sharing and intention to share knowledge, can be extracted using the principal component analysis. The result is consistent with the literature; therefore, the measurement of knowledge sharing willingness has construct validity.

Table 5.11: Pattern Matrix (for KSW)

<table>
<thead>
<tr>
<th></th>
<th>component 1</th>
<th>component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attitude toward knowledge sharing</td>
<td>Intention to share knowledge</td>
</tr>
<tr>
<td>AKSW3</td>
<td>.876</td>
<td>.298</td>
</tr>
<tr>
<td>AKSW2</td>
<td>.867</td>
<td>.270</td>
</tr>
<tr>
<td>AKSW4</td>
<td>.835</td>
<td>.346</td>
</tr>
<tr>
<td>AKSW1</td>
<td>.663</td>
<td>.496</td>
</tr>
<tr>
<td>IKSW2</td>
<td>.212</td>
<td>.816</td>
</tr>
<tr>
<td>IKSW3</td>
<td>.257</td>
<td>.812</td>
</tr>
<tr>
<td>IKSW4</td>
<td>.472</td>
<td>.787</td>
</tr>
<tr>
<td>IKSW1</td>
<td>.183</td>
<td>.640</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization
a Rotation converged in 3 iterations

Knowledge Sharing Behaviour

The result of KMO and Bartlett’s test shows that the data set of knowledge sharing behaviour is suitable for doing factor analysis; the KMO value is .774 (>0.6) at the significance level of P<.001. After running factor analysis using SPSS, only the first two factors are retained as their eigenvalues are greater than 1 (the values are 5.642 and 1.239 respectively), and the cumulative percentage of variance accounted for by the first two factors together is 68.817%. The two main components, internalisation and externalisation, can be extracted using the principal component analysis. The result is consistent with the literature; therefore, the measurement of knowledge sharing behaviour has construct validity.
Table 5.12: KMO and Bartlett’s test and Total Variance Explained (for KSB)

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin measure of sampling adequacy</th>
<th>Factor</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>5.642</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.239</td>
</tr>
</tbody>
</table>

Bartlett’s Test of Sphericity
- Approx. Chi-Square: 267.647
- Df: 45
- Sig.: <.001

Table 5.13: Pattern Matrix (for KSB)

<table>
<thead>
<tr>
<th>Component</th>
<th>Internalisation</th>
<th>Externalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IKSBJ</td>
<td>.848</td>
<td>.246</td>
</tr>
<tr>
<td>IKSBJ</td>
<td>.842</td>
<td>.288</td>
</tr>
<tr>
<td>IKSBJ</td>
<td>.770</td>
<td>.105</td>
</tr>
<tr>
<td>IKSBJ</td>
<td>.734</td>
<td>.451</td>
</tr>
<tr>
<td>EKSBJ</td>
<td>.296</td>
<td>.839</td>
</tr>
<tr>
<td>EKSBJ</td>
<td>.150</td>
<td>.801</td>
</tr>
<tr>
<td>EKSBJ</td>
<td>.166</td>
<td>.782</td>
</tr>
<tr>
<td>EKSBJ</td>
<td>.445</td>
<td>.746</td>
</tr>
<tr>
<td>EKSBJ</td>
<td>.472</td>
<td>.666</td>
</tr>
<tr>
<td>EKSBJ</td>
<td>.335</td>
<td>.581</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization
a Rotation converged in 3 iterations

Member’s Satisfaction

The result of KMO and Bartlett’s test shows that the data set of member satisfaction is suitable for doing factor analysis; the KMO is .923 (>0.6) at the significance level of p<.001.

Table 5.14: KMO and Bartlett’s test and Total Variance Explained (for MS)

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin measure of sampling adequacy</th>
<th>Factor</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>5.601</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.704</td>
</tr>
</tbody>
</table>

Bartlett’s Test of Sphericity
- Approx. Chi-Square: 348.161
- Df: 36
- Sig.: <.001
After running factor analysis using SPSS, only the first two factors are retained as their eigenvalues are greater than 1 (the values are 5.601 and 1.704 respectively), and the cumulative percentage of variance accounted for by the first two factors together is 81.162%. The two main components, satisfaction with outcomes of cooperation and satisfaction with processes of cooperation, can be extracted using the principal component analysis. The result is consistent with the literature; therefore, the measurement of member satisfaction has construct validity.

Table 5.15: Pattern Matrix (for MS)

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with outcomes of cooperation</td>
<td>.878</td>
<td>.338</td>
</tr>
<tr>
<td>Satisfaction with processes of cooperation</td>
<td>.809</td>
<td>.484</td>
</tr>
<tr>
<td>MSO1</td>
<td>.792</td>
<td>.460</td>
</tr>
<tr>
<td>MSO2</td>
<td>.737</td>
<td>.495</td>
</tr>
<tr>
<td>MSP3</td>
<td>.246</td>
<td>.877</td>
</tr>
<tr>
<td>MSP4</td>
<td>.389</td>
<td>.834</td>
</tr>
<tr>
<td>MSP1</td>
<td>.287</td>
<td>.829</td>
</tr>
<tr>
<td>MSP5</td>
<td>.499</td>
<td>.752</td>
</tr>
<tr>
<td>MSP2</td>
<td>.342</td>
<td>.725</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization
a Rotation converged in 3 iterations

5.3 Demographic Data Analysis

This research emphasises the individual competencies which overcome the cross-national boundaries for dealing with different cultural background; thus, the individual’s cross-cultural experience is the focus of the investigation of demographic data analysis. The demographic questions were developed by the nature of the sample for experiment design, including the experimental participant’s information about gender, age, study experience (i.e., studying overseas) and working experience (e.g.,
working overseas). Question items for demographic investigation can be seen in Appendix 1.

5.3.1 Sample Profile

An overall profile of the sample at both pre-test and post-test are provided by using descriptive statistics, as can be seen in Table 5.16 and Table 5.17 below. At the commencement of the experiment, 61 respondents completed the pre-test and agreed to participate in the virtual team exercise.

<table>
<thead>
<tr>
<th>Table 5.16: Respondents’ demographic characteristics in the pre-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic Variable</td>
</tr>
<tr>
<td>Gender (N=61)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Age (N=61)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Study abroad (N=61)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Study abroad experience (N=15)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Working abroad (N=38)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Working abroad experience (N=8)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note: in pre-test, 38 respondents (62%) have working experience

However, at the completion of the experimental exercise, only 42 participants responded to the post-test. There are 19 participant responses missing for the post-test.
Table 5.17: Respondents’ demographic characteristics in the post-test

<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (N=42)</td>
<td>Male</td>
<td>20</td>
<td>48%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>22</td>
<td>52%</td>
</tr>
<tr>
<td>Age ((N=42)</td>
<td>20-24 years old</td>
<td>20</td>
<td>48%</td>
</tr>
<tr>
<td></td>
<td>25-30 years old</td>
<td>16</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td>31-35 years old</td>
<td>4</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>36-40 years old</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Study abroad (N=42)</td>
<td>Yes</td>
<td>11</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>31</td>
<td>74%</td>
</tr>
<tr>
<td>Study abroad experience (N=11)</td>
<td>Less than 1 year</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>6</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>3-5 years</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>More than 10 years</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td>Note: in post-test, 34 respondents (81 %) have working experience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working abroad (N=34)</td>
<td>Yes</td>
<td>6</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>28</td>
<td>82%</td>
</tr>
<tr>
<td>Working abroad experience (N=6)</td>
<td>Less than 1 year</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>5-10 years</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>More than 10 years</td>
<td>1</td>
<td>17%</td>
</tr>
</tbody>
</table>

Those missing respondents could have already abandoned working in the virtual team exercise during the experimental period due to some private reasons. For example, they may have had demands in their personal life or they were disappointed about participating in the virtual team exercise so they did not keep participating in this research project. Losing team members sometimes occurs in conventional team cooperation so this study has already assumed that a reduced number of respondents could happen. The qualitative findings in Chapter 6 will explain the reasons for declined participation.

5.3.2 Demographic Data Analysis

This research examined the difference between respondents’ gender, age, study experience, and work experience in both the pre-test and post-test. At the commencement of the experiment, there were no significant differences between male
and female participants in their individual cultural intelligence (p>.05), individual cultural openness (p>.05), self-efficacy (p>.05), and knowledge sharing willingness (p>.05). Similarly, there was no significant difference among the various ages of participants in the variables above (p>.05). However, participants who had experience studying or working abroad had higher individual cultural intelligence, individual cultural openness, and self-efficacy than participants who had not studied or worked abroad; also, they were more willing to share their knowledge in the virtual team. The result of demographic analysis for the pre-test is shown in Table 5.18 below.

<table>
<thead>
<tr>
<th>Table 5.18: Demographic data analysis in the pre-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CQ</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CO</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SE</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>KSW</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Std. Deviation are reported in parentheses

At the completion of the experimental exercise, participants’ different gender and ages still did not have significant differences in their individual cultural intelligence (both p>.05), individual cultural openness (both p>.05), self-efficacy (both p>.05), and knowledge sharing willingness (both p>.05); also, they did not show significant differences in their individual knowledge sharing behaviour (both p>.05) and member satisfaction (both p>.05). However, participants with study abroad experience have
higher individual cultural intelligence and self-efficacy than participants who have not
studied abroad; also, they are more willing to share their knowledge in the virtual
team. Yet, there is no significant difference in individual cultural openness (p>.05),
knowledge sharing behaviour (p>.05) and member satisfaction (p>.05). Besides,
participants with working abroad experience have higher knowledge sharing
willingness but there is no significant difference in individual cultural intelligence,
individual cultural openness, self-efficacy, knowledge sharing behaviour, and member
satisfaction. Table 5.19 shows the results of demographic analysis in the post-test.

Table 5.19: Demographic data analysis in the post-test

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Age</th>
<th>Study Abroad Experience</th>
<th>Work Abroad Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>T-Test</td>
<td>ANOVA</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>P</td>
<td>Mean</td>
<td>P</td>
</tr>
<tr>
<td>CQ</td>
<td>.750</td>
<td>.100</td>
<td>Yes 73.600</td>
<td>(9.9911)</td>
</tr>
<tr>
<td>SE</td>
<td>.893</td>
<td>.052</td>
<td>Yes 32.3000</td>
<td>(4.6678)</td>
</tr>
<tr>
<td>KSW</td>
<td>.743</td>
<td>.084</td>
<td>Yes 47.7000</td>
<td>(7.0875)</td>
</tr>
<tr>
<td>KSB</td>
<td>.729</td>
<td>.429</td>
<td>Yes 46.2000</td>
<td>(6.5794)</td>
</tr>
<tr>
<td>MS</td>
<td>.560</td>
<td>.627</td>
<td>Yes 33.7000</td>
<td>(15.026)</td>
</tr>
</tbody>
</table>

Std. Deviation are reported in parentheses

As described, the relationship between study abroad experience and individual
cultural openness has been changed. A result of the pre-test indicates that participants
with more study abroad experience should have higher individual cultural openness.
However, the post-test result shows that the significant influence of study abroad
experience on individual cultural openness disappeared after respondents participated in the virtual team exercise. Moreover, another difference in the results between pre-test and post-test is the effect of individual working abroad experience. In the pre-test, the findings show that participants with more working abroad experience should have higher individual cultural intelligence, individual cultural openness and self-efficacy. Yet, from the post-test, it can be seen that working abroad experience does not have a significant influence on individual cultural intelligence, individual cultural openness and self-efficacy. The two differences outline above are interesting findings, and the reasons for these should be explored in this study. Thus, this thesis will discuss the potential reasons by using qualitative data in Chapter 6.

5.4 Testing Quasi-Experimental Design

As stated in Chapter 4, this research is a factorial experimental design in which three independent variables, individual cultural intelligence, individual cultural openness, and self-efficacy, have been manipulated by two different levels, high and low. The ANOVA is used to test factorial designs to analyse an experiment with independent variables (Chiou, 2000). Factorial design can provide unique and relevant information about how variables interact in the effect they have on the dependent variables. If there are two independent variables, factor A and factor B, in a factorial experimental design, two-way ANOVA can be used to examine the main effect of A and B as well as one interaction effect (A × B). Three-way ANOVA will be utilised if three independent variables at a time need to be tested in the experiment as there could be three two-way interactions (A × B, A × C, B × C) and one three-way interaction (A × B × C) (Chiou, 2000). As a result, three-way ANOVA is the most suitable method of analysis applying in this study.
This research allocated experiment participants into different virtual team groups based on the responses of a pre-test. By analysis of the pre-test utilising three-way ANOVA, the main effects of factors and interaction between factors can be easily understood. There is a significant main effect if a significant F-value is found for one independent variable; moreover, there are always interaction effects between the independent variables that may or may not be significant.

As shown in Table 5.20 and Table 5.21, the research found that both the level of individual cultural intelligence and the level of self-efficacy do not have significant main effects on knowledge sharing willingness; by contrast, the level of individual cultural openness has a significant main effect on knowledge sharing willingness. Moreover, there is no significant cultural intelligence × cultural openness interaction effect and cultural openness × self-efficacy interaction effect on knowledge sharing willingness. However, the interaction effect of cultural intelligence × self-efficacy can influence knowledge sharing willingness; also, the interaction effect of cultural intelligence × cultural openness × self-efficacy can influence knowledge sharing willingness. Virtual teams which have members with high levels in all three characteristics, individual cultural intelligence, individual cultural openness, and self-efficacy, get better knowledge sharing willingness (mean=51.1500) from team members for the teamwork. Conversely, groups with low levels in all three characteristics are unhappy to share knowledge within a team (mean=41.3846). From the results of the three-way ANOVA, we can see that the experimental design is appropriately applied in this research. Different characteristics of virtual teams have been successfully built by allocating virtual team members because the interaction effect of cultural intelligence × cultural openness × self-efficacy in different types of virtual teams has been shown and its influence on knowledge sharing willingness is
proven.

Table 5.20: Three-way ANOVA for factorial experimental design

<table>
<thead>
<tr>
<th>Source</th>
<th>Type Sum of squares</th>
<th>DF</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>CQ level</td>
<td>4.079</td>
<td>1</td>
<td>4.079</td>
<td>.181</td>
<td>.672</td>
</tr>
<tr>
<td>CO level</td>
<td>117.055</td>
<td>1</td>
<td>117.055</td>
<td>5.208</td>
<td>.027</td>
</tr>
<tr>
<td>SE level</td>
<td>14.177</td>
<td>1</td>
<td>14.177</td>
<td>.631</td>
<td>.431</td>
</tr>
<tr>
<td>CQ level × CO level</td>
<td>10.298</td>
<td>1</td>
<td>10.298</td>
<td>.458</td>
<td>.502</td>
</tr>
<tr>
<td>CQ level × SE level</td>
<td>99.679</td>
<td>1</td>
<td>99.679</td>
<td>4.435</td>
<td>.041</td>
</tr>
<tr>
<td>CO level × SE level</td>
<td>32.356</td>
<td>1</td>
<td>32.356</td>
<td>1.440</td>
<td>.236</td>
</tr>
<tr>
<td>CQ level × CO level × SE level</td>
<td>135.620</td>
<td>1</td>
<td>135.620</td>
<td>.018</td>
<td></td>
</tr>
</tbody>
</table>

Dependent variable: KSW

Table 5.21: Comparison of different interaction effects

<table>
<thead>
<tr>
<th>CQ level</th>
<th>CO level</th>
<th>SE level</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>--(None)</td>
<td>High</td>
<td>--(None)</td>
<td>49.7500</td>
<td>4.2586</td>
</tr>
<tr>
<td>--(None)</td>
<td>Low</td>
<td>--(None)</td>
<td>42.6842</td>
<td>6.5239</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>High</td>
<td>51.1500</td>
<td>4.1836</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td>46.6667</td>
<td>3.0550</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>38.5000</td>
<td>12.0208</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td>48.0000</td>
<td>10.115</td>
</tr>
<tr>
<td>--(None)</td>
<td>High</td>
<td>Low</td>
<td>50.0000</td>
<td>6.04743</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td>47.0000</td>
<td>2.58199</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>50.0000</td>
<td>4.60435</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td>46.8571</td>
<td>2.91139</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>49.3333</td>
<td>6.50641</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td>41.3846</td>
<td>5.15652</td>
</tr>
<tr>
<td>--(None)</td>
<td>High</td>
<td>Low</td>
<td>49.7778</td>
<td>4.89331</td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td>43.3000</td>
<td>5.16160</td>
</tr>
</tbody>
</table>

Dependent variable: KSW

5.5 Investigating Research Hypotheses

Through a review of the literature, this research assumes that the variables, individual cultural intelligence, individual cultural openness, and self-efficacy, can positively
influence a virtual team’s knowledge sharing and a member’s satisfaction. Regression analysis is a commonly used statistical tool to investigate the relationships between the variables observed and it is used to seek the causal effect of one variable upon another; for example, the effect of a score increase in a maths examine upon the study hours (Chiou, 2000). To explore this assumption, this thesis collects data about the variables mentioned above and utilises regression to estimate the quantitative effect of the causal variable.

5.5.1 H1: The Effect of Individual Cultural Intelligence

The causal relationship proposed in Hypothesis 1 is that team members who have high individual cultural intelligence are more willing to share knowledge in a virtual team; also, that knowledge sharing behaviour within a team can be performed better. It is a positive effect that individual cultural intelligence can predict a virtual team’s knowledge sharing. Two regressions can be conducted in this hypothesis. H1(a) knowledge sharing willingness is the dependent variable, regressed on individual cultural intelligence as an independent variable; and H1(b) knowledge sharing behaviour is the dependent variable, regressed on individual cultural intelligence as an independent variable.

**Testing H1(a)**

The regression contains only one independent variable so simple regression analysis is applied. The regression analysis was done twice because those two observed variables, individual cultural intelligence (CQ) and knowledge sharing willingness (KSW), have been examined in both pre-test and post-test.

For the pre-test, regression analysis shows that the correlation between CQ and KSW
is statistically significant ($r = .441, p<.05$) and $R^2 = .176$. An ANOVA confirms that the regression equation is significant ($p<.05$), indicating the direct effect of $CQ$ on $KSW$. Moreover, the standardised beta coefficient is $0.441 (p< .05)$ and the regression equation can be shown as:

Knowledge sharing willingness predicted = 26.588 + .234 individual cultural intelligence.

### Table 5.22: KSW related to CQ (pre-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>336.665</td>
<td>1</td>
<td>336.665</td>
<td>10.381</td>
<td>.002</td>
</tr>
<tr>
<td>Residual</td>
<td>1394.579</td>
<td>43</td>
<td>32.432</td>
<td>R Square = .194</td>
<td>Adjusted $R^2 = .176$</td>
</tr>
<tr>
<td>Total</td>
<td>1731.244</td>
<td>44</td>
<td></td>
<td>Std. Error of the Estimate = 5.69492</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>26.588</td>
<td>6.542</td>
<td>4.064</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>CQ</td>
<td>.441</td>
<td>.234</td>
<td>.441</td>
<td>3.222</td>
<td>.002</td>
</tr>
</tbody>
</table>

*a Predictors: (Constant), CQ  
b Dependent variable : KSW

For the post-test, regression analysis shows that the correlation between $CQ$ and $KSW$ is not significant ($r = .236, p>.05$) and $R^2 = .056$. An ANOVA confirms that the regression equation is not significant ($p>.05$), indicating no direct effect of $CQ$ on $KSW$. Moreover, the standardised beta coefficient is $0.236$ but the effect is not significant ($p>.05$).

### Table 5.23: KSW related to CQ (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>140.225</td>
<td>1</td>
<td>140.225</td>
<td>2.242</td>
<td>.143</td>
</tr>
<tr>
<td>Residual</td>
<td>2377.150</td>
<td>38</td>
<td>62.557</td>
<td>R Square = .056</td>
<td>Adjusted $R^2 = .031$</td>
</tr>
<tr>
<td>Total</td>
<td>2517.375</td>
<td>39</td>
<td></td>
<td>Std. Error of the Estimate = 7.90927</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>31.532</td>
<td>7.349</td>
<td>4.291</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>CQ</td>
<td>.236</td>
<td>.155</td>
<td>.104</td>
<td>.236</td>
<td>.497</td>
</tr>
</tbody>
</table>

*a Predictors: (Constant), CQ  
b Dependent variable : KSW
As described, the direct effect of CQ on KSW can be proved in the pre-test but the post-test result cannot support that CQ has a main effect in influencing KSW; thus, H1(a) is partly supported. It is important to find potential reasons to explain why the impact of CQ on KSW has been changed and this research will discuss this issue by analysing qualitative data in Chapter 6.

**Testing H1(b)**

This study can only investigate H1(b) once in the post-test since the dependent variable, knowledge sharing behaviour (KWB), has not been examined in the pre-test. Regression analysis in the post-test shows that the correlation between CQ and KSB is not significant ($r = .017$, $p > .05$) and $R^2 < .001$. An ANOVA confirms that the regression equation is not significant ($p > .05$), indicating no direct effect of CQ on KSB. Moreover, the standardised beta coefficient is .017 but the effect is not significant ($p > .05$).

<table>
<thead>
<tr>
<th>Table 5.24: KSB related to CQ (post-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>46.061</td>
<td>9.557</td>
<td>4.820</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>CQ</td>
<td>.017 ($p = .460$)</td>
<td>.014</td>
<td>.135</td>
<td>.017</td>
<td>.102</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), CQ
b Dependent variable: KSB

From the result of regression analysis, the direct effect of CQ on KSB cannot be found, thus H1(b) is not supported. However, this finding is different from the
assumption made following the literature review. It is important to find potential reasons to explain why CQ does not have a main effect in influencing KSB in this study. The qualitative findings, which are outlined in Chapter 6 and Chapter 7, will provide comprehensive explanations.

5.5.2 H2: The Effect of Individual Cultural Openness

The causal relationship proposed in Hypothesis 2 is that team members who have high individual cultural openness are more willing to share knowledge in a virtual team; also, that knowledge sharing behaviour within a team can be performed better. It is a positive effect that individual cultural openness can predict a virtual team’s knowledge sharing. Two regressions can be conducted for this hypothesis. H2(a) knowledge sharing willingness is the dependent variable, regressed on individual cultural openness as an independent variable, and H2(b) knowledge sharing behaviour is the dependent variable, regressed on individual cultural openness as an independent variable.

Testing H2(a)

The regression analysis was conducted twice, given that those two observed variables, individual cultural openness (CO) and knowledge sharing willingness (KSW), have been examined in both the pre-test and post-test.

For the pre-test, regression analysis shows that the correlation between CO and KSW is statistically significant ($r = .635$, $p<.05$) and $R^2 = .403$. An ANOVA confirms that the regression equation is significant ($p<.05$), indicating the direct effect of CO on KSW. Moreover, the standardised beta coefficient is .635 ($p<.05$) and the regression equation can be shown as:
Knowledge sharing willingness predicted = 23.038 + .855 individual cultural openness.

Table 5.25: KSW related to CO (pre-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>815.421</td>
<td>1</td>
<td>815.421</td>
</tr>
<tr>
<td>Residual</td>
<td>1206.324</td>
<td>53</td>
<td>22.761</td>
</tr>
<tr>
<td>Total</td>
<td>2021.745</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>23.038</td>
<td>4.106</td>
<td>.143</td>
<td>5.611</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CO</td>
<td>.635 (p= .000)</td>
<td>.855</td>
<td>.143</td>
<td>.635</td>
<td>5.985</td>
</tr>
</tbody>
</table>

For the post-test, regression analysis shows that the correlation between CO and KSW is not significant (r= .186, p>.05) and R Square = .035. An ANOVA confirms that the regression equation is not significant (p>.05), indicating no direct effect of CO on KSW. Moreover, the standardised beta coefficient is .186 but the effect is not significant (p>.05).

Table 5.26: KSW related to CO (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>87.206</td>
<td>1</td>
<td>87.206</td>
</tr>
<tr>
<td>Residual</td>
<td>2430.169</td>
<td>38</td>
<td>63.952</td>
</tr>
<tr>
<td>Total</td>
<td>2517.375</td>
<td>39</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>33.337</td>
<td>7.843</td>
<td>.186</td>
<td>4.251</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CO</td>
<td>.186 (p= .125)</td>
<td>.353</td>
<td>.302</td>
<td>.186</td>
<td>1.168</td>
</tr>
</tbody>
</table>

As described, the direct effect of CO on KSW can be proved in the pre-test but the
post-test result cannot support that CO has a main effect in influencing KSW, thus, H2(a) is partly supported. It is important to find potential reasons to explain why the impact of CO on KSW has changed and this research will explore this issue through a discussion of the analysis of the qualitative data in Chapter 6.

**Testing H2(b)**

This study can only investigate H2(b) once in the post-test since the dependent variable, knowledge sharing behaviour (KSB), was not examined in the pre-test. Regression analysis in the post-test shows that the correlation between CO and KSB is not significant \( (r = -0.080, p > 0.05) \) and \( R^2 = 0.006 \). An ANOVA confirms that the regression equation is not significant \( (p > 0.05) \), indicating no direct effect of CO on KSB. Moreover, the standardised beta coefficient is -0.080 but the effect is not significant \( (p > 0.05) \).

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>25.513</td>
<td>1</td>
<td>25.513</td>
<td>0.243</td>
<td>0.625</td>
<td>0.006</td>
<td>-0.020</td>
<td>10.25396</td>
</tr>
<tr>
<td>Residual</td>
<td>3995.462</td>
<td>38</td>
<td>105.144</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4020.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(Constant)</th>
<th>CO</th>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.080 (<em>p</em> &lt; 0.01)</td>
<td>-0.191</td>
<td>-0.388</td>
<td>-0.080</td>
<td>-0.493</td>
<td>5.162</td>
<td>&lt;0.001</td>
<td>0.625</td>
</tr>
</tbody>
</table>

From the results of the regression analysis, the direct effect of CO on KSB cannot be found, thus, H2(b) is not supported. However, this finding is different from the assumption made following the literature review. It is important to find potential reasons to explain why CO does not have a main effect in influencing KSB in this...
study. These issues will be discussed further in Chapter 6 and Chapter 7.

5.5.3 H3: The Effect of Self-efficacy

The causal relationship proposed in Hypothesis 3 is that team members who have high self-efficacy are more willing to share knowledge in a virtual team; also, knowledge sharing behaviour within a team can be performed better. It is a positive effect that self-efficacy can predict a virtual team’s knowledge sharing. Two regressions can be conducted in this hypothesis. H3(a) knowledge sharing willingness is the dependent variable, regressed on self-efficacy as an independent variable, and H3(b) knowledge sharing behaviour is the dependent variable, regressed on self-efficacy as an independent variable.

Testing H3(a)

The regression analysis was conducted twice in this study, given that the two observed variables, self-efficacy (SE) and knowledge sharing willingness (KSW), have been examined in both the pre-test and post-test.

For the pre-test, regression analysis shows that the correlation between SE and KSW is statistically significant ($r = .445$, $p < .05$) and $R^2 = .198$. An ANOVA confirms that the regression equation is significant ($p < .05$), indicating the direct effect of SE on KSW. Moreover, the standardised beta coefficient is $.445$ ($p < .05$) and the regression equation can be shown as:

$$\text{Knowledge sharing willingness predicted} = 27.365 + .595 \text{ self-efficacy}.$$
Table 5.28: KSW related to SE (pre-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F = 13.063</th>
<th>P = .001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>399.778</td>
<td>1</td>
<td>399.778</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>1621.967</td>
<td>53</td>
<td>30.603</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2021.745</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>27.365</td>
<td>5.568</td>
<td>4.914</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE</td>
<td>.445 (p=.000)</td>
<td>.595</td>
<td>.165</td>
<td>.445</td>
<td>3.614</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), SE  
b Dependent variable: KSW

For the post-test, regression analysis shows that the correlation between SE and KSW is statistically significant (r=.414, p<.05) and R Square = .171. An ANOVA confirms that the regression equation is significant (p<.05), indicating the direct effect of SE on KSW. Moreover, the standardised beta coefficient is .414 (p<.05) and the regression equation can be shown as:

Knowledge sharing willingness predicted = 29.449 + .479 self-efficacy.

Table 5.29: KSW related to SE (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F = 7.858</th>
<th>P = .008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>431.350</td>
<td>1</td>
<td>431.350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>2086.025</td>
<td>38</td>
<td>54.895</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2517.375</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>29.449</td>
<td>4.758</td>
<td>6.190</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SE</td>
<td>.414 (p=.004)</td>
<td>.595</td>
<td>.165</td>
<td>.445</td>
<td>2.803</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), SE  
b Dependent variable: KSW

As described above, the direct effect of SE on KSW can be proved in both pre-test and post-test, thus H3(a) can be supported.
**Testing H3(b)**

This study can only investigate H3(b) once in the post-test since the dependent variable, knowledge sharing behaviour (KSB), has not been examined in the pre-test. Regression analysis in the post-test shows that the correlation between SE and KSB is not significant ($r = .085$, $p > .05$) and R Square = .007. An ANOVA confirms that the regression equation is not significant ($p > .05$), indicating no direct effect of SE on KSB. Moreover, the standardised beta coefficient is .085 but the effect is not significant ($p > .05$).

**Table 5.30: KSB related to SE (post-test)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>28.846</td>
<td>1</td>
<td>28.846</td>
<td>.275</td>
<td>.603</td>
<td>.007</td>
<td>-.019</td>
<td>10.24968</td>
</tr>
<tr>
<td>Residual</td>
<td>3992.129</td>
<td>38</td>
<td>105.056</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4020.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>.085 (p = .302)</td>
<td>43.682</td>
<td>6.582</td>
<td>6.637</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td></td>
<td>.124</td>
<td>.236</td>
<td>.085</td>
<td>.524</td>
<td>.603</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), SE
b Dependent variable: KSB

From the results of the regression analysis, the direct effect of SE on KSB cannot be found, thus H3(b) is not supported. However, this finding is different from the assumption made following the literature review. It is important to find potential reasons to explain why SE does not have a main effect in influencing KSB in this study. Further discussion and explanation will be provided in Chapters 6 and Chapter 7.

**5.5.4 H4: The Relationship between Individual Competence Factors**

Hypothesis 4 is distinguished from the other hypotheses because a causal effect
between observed variables is not assumed. In accordance with the literature review, this research proposes that there are correlations between individual cultural intelligence, individual cultural openness, and self-efficacy, but cannot presume that a causal relationship exists in the variables outlined above. To investigate the relationship between the variables observed, Person’s Correlation is a commonly used technique because it can test the strength of the association between two continuous variables by correlation that can reflect the degree to which the variables are related (Chiou, 2000). Pearson's correlation coefficients ranges from -1 to +1. A correlation of +1 means a perfect positive linear relationship between variables; conversely, a correlation of -1 means a perfect negative linear relationship between variables. The positive relationship between two variables shows that high scores on the X variable are associated with high scores on the Y variable. This research utilised Pearson’s correlation technique to investigate Hypothesis 4 twice since three variables, individual cultural intelligence (CQ), individual cultural openness (CO), and self-efficacy (SE), have been examined in both the pre-test and post-test.

Pearson’s correlations in the pre-test shows that the correlations specified in Hypothesis 4 are all significant (CQ/CO=.625, p<.01; CO/SE=.567, p<.01; CQ/SE=.601, p<.01). Similar results were found in the post-test, the positive relationship between CQ, CO, and SE are proved because the correlations are all significant (CQ/CO=.543, p<.01; CO/SE=.429, p<.01; CQ/SE=.678, p<.01). The correlation results of pre-test and pos-test are shown in Table 5.9 and Table 5.10.
Table 5.31: Pearson’s Correlation for the pre-test

<table>
<thead>
<tr>
<th></th>
<th>Cultural intelligence</th>
<th>Cultural openness</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Intelligence</td>
<td>Pearson Correlation</td>
<td>.625**</td>
<td>.601**</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cultural Openness</td>
<td>Pearson Correlation</td>
<td>.625**</td>
<td>.567**</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Pearson Correlation</td>
<td>.601**</td>
<td>.567**</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed)

Table 5.32: Pearson’s Correlation for the post-test

<table>
<thead>
<tr>
<th></th>
<th>Cultural intelligence</th>
<th>Cultural openness</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Intelligence</td>
<td>Pearson Correlation</td>
<td>.543**</td>
<td>.678**</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cultural Openness</td>
<td>Pearson Correlation</td>
<td>.543**</td>
<td>.429**</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt;.001</td>
<td>&lt;.003</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Pearson Correlation</td>
<td>.678**</td>
<td>.429**</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>&lt;.001</td>
<td>&lt;.003</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed)

Based on the data above, Hypothesis 4 can be supported because H4 (a) CQ is positively correlated with CQ, H4 (b) CO is positively correlated with SE, and H4 (c) CQ is positively correlated with SE are supported. This finding is consistent with the assumption made in the existing literature.

5.5.5 H5: The Causal Relationship between Knowledge Sharing Factors

From previous relevant studies, this research assumes that individual knowledge sharing willingness can positively influence a virtual team’s knowledge sharing behaviour. A causal relationship is proposed in the Hypothesis 5, that knowledge sharing willingness can predict knowledge sharing behaviour in the team. Therefore, this study utilised regression analysis to test the hypothesis, such that knowledge sharing behaviour (KSB) is the dependent variable, regressed on knowledge sharing
willingness (KSW) as an independent variable.

This study can only investigate H5 once in the post-test since the dependent variable, KSB, has not examined in the pre-test. Regression analysis in the post-test shows that the correlation between KSW and KSB is not significant (r = .092, p > .05) and R Square = .008. An ANOVA confirms that the regression equation is not significant (p > .05), indicating no direct effect of KSW on KSB. Moreover, the standardised beta coefficient is .092 but the effect is not significant (p > .05).

Table 5.33: KSB related to KSW (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>33.783</td>
<td>1</td>
<td>33.783</td>
<td>.322</td>
<td>.574</td>
<td>.008</td>
<td>-.018</td>
<td>10.24334</td>
</tr>
<tr>
<td>Residual</td>
<td>3987.192</td>
<td>38</td>
<td>104.926</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4020.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>42.116</td>
<td>8.802</td>
<td>4.785</td>
<td></td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>KSW .092 (p=.287)</td>
<td>.116</td>
<td>.204</td>
<td>.092</td>
<td>.567</td>
<td>.574</td>
<td></td>
</tr>
</tbody>
</table>

a Predictors: (Constant), KSW
b Dependent variable: KSB

From the result of the regression analysis, the direct effect of KSW on KSB cannot be found, thus H5 is not supported. However, this finding is different from the assumption made in the literature review. It is important to find potential reasons to explain why KSW does not have a main effect in influencing KSB in this study. Theses issues will be discussed in more depth in Chapter 6 and Chapter 7.

5.5.6 H6: The Effect of Knowledge Sharing on Member’s Satisfaction

The causal relationship proposed in Hypothesis 6 is that virtual team members’ satisfaction can be positively influenced by knowledge sharing within a team. As a
virtual team’s knowledge sharing contains two observed variables, KSW and KSB, two regressions can be conducted in this hypothesis. H6 (a) member’s satisfaction is the dependent variable, regressed on knowledge sharing willingness as an independent variable, and H6 (b) member’s satisfaction is the dependent variable, regressed on knowledge sharing behaviour as an independent variable.

Testing H6 (a)
This study can only investigate H6 (a) once in the post-test since the dependent variable, member’s satisfaction (MS), has not examined in the pre-test. Regression analysis in the post-test shows that the correlation between KSW and MS is not significant (r = -.046, p > .05) and R Square = .002. An ANOVA confirms that the regression equation is not significant (p > .05), indicating no direct effect of KSW on MS. Moreover, the standardised beta coefficient is -.046 but the effect is not significant (p > .05).

Table 5.34: MS related to KSW (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F =</th>
<th>P =</th>
<th>R Square =</th>
<th>Adjusted R Square =</th>
<th>Std. Error of the Estimate =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>9.590</td>
<td>1</td>
<td>9.590</td>
<td>.079</td>
<td>.780</td>
<td>.002</td>
<td>-.024</td>
<td>11.01122</td>
</tr>
<tr>
<td>Residual</td>
<td>4607.385</td>
<td>38</td>
<td>121.247</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4616.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>41.640</td>
<td>9.461</td>
<td>4.401</td>
<td>&lt; .001</td>
<td></td>
</tr>
<tr>
<td>KSW</td>
<td>-.046 (p = .390)</td>
<td>-.062</td>
<td>.219</td>
<td>-.046</td>
<td>-.281</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), KSW
b Dependent variable : MS

From the result of the regression analysis, the direct effect of KSW on MS cannot be found, thus H6 (a) is not supported. However, this finding is different from the assumption made in the literature review. It is important to find potential reasons to
explain why KSW does not have a main effect in influencing MS in this study. These
issues will be discussed and explained further in Chapter 6 and Chapter 7.

Testing H6 (b)

This study can only investigate H6 (b) once in the post-test since both the independent
variable, knowledge sharing behaviour (KSB), and the dependent variable, member’s
satisfaction (MS), have not been examined in the pre-test. Regression analysis in the
post-test shows that the correlation between KSB and MS is statistically significant
\((r = .587, p < .05)\) and \(R^2 = .345\). An ANOVA confirms that the regression
equation is significant \((p < .05)\), indicating the direct effect of KSB on MS. Moreover,
the standardised beta coefficient is \(.587 (p < .05)\) and the regression equation can be
shown as:

\[
\text{Member’s satisfaction predicted} = 9.532 + .627 \text{ knowledge sharing behaviour.}
\]

<table>
<thead>
<tr>
<th></th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>(F = 20.515)</th>
<th>(P &lt; .001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1603.708</td>
<td>1</td>
<td>1603.708</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>3048.682</td>
<td>39</td>
<td>78.171</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4652.390</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td>9.532</td>
<td>6.625</td>
<td>1.439</td>
<td>.158</td>
<td></td>
</tr>
<tr>
<td>KSB</td>
<td>.587 ((p = .000))</td>
<td>.627</td>
<td>.138</td>
<td>.587</td>
<td>4.529</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

As described above, the direct effect of KSB on MS can be proved, thus H6 (b) can be
supported.
5.5.7 H7: Indirect Effects of Individual Competencies on Member’s Satisfaction

This research proposes in Hypothesis 7 that individual competencies, CQ, CO, and SE, may have indirect effects on member’s satisfaction (MS) through the influence of the virtual team’s knowledge sharing. Path analysis is used to discuss direct and indirect components in a systematic model formed by basic hypotheses, and the decomposition of effects into these components (Alwin and Hauser, 1975). Making explicit the rationale of conventional regression calculations and measuring decomposing effects into dependent variables are two functions of using path analysis (Duncan, 1966). Accordingly, path analysis is utilised to examine the hypothesised relationships among variables to investigate the relative magnitudes of the indirect effects of the three independent variables outlined above on MS. However, conducting an effective path analysis by the use of structure equation modelling (SEM) requires a large research sample that should be not less than 100 cases (Loehlin, 2004). The number of experimental participants in this study is less than 100 so SEM is not appropriate to be applied in this research. Thus, multiple regressions is utilised to do the path analysis in this study, as this technique has been referenced by several researchers, such as Bryman and Cramer (1994), and Everitt and Dunn (2001).

By conducting multiple regression using SPSS, this study tests the path analysis that theoretical propositions about cause and effect as a whole model. The hypothesised causal ordering for how CQ, CO, and SE cause MS through a virtual team’s knowledge sharing is shown as a model below.
For the full model above, three layers of multiple regressions are needed. They are:
the first layer, with KSW as the criterion, and CQ, CO, and SE as the predictors; the
second layer, with KSB as the criterion, and CQ, CO, SE, and KSW as the predictors;
and finally, the third layer, with MS as the criterion, and KSW, and KSB as the
predictors. It can be seen that the second layer of multiple regression has the most
variables, including four independent variables. According to Cohen and Cohen
(1983), with an alpha (α) level of 0.05, four independent variables, and a moderate
effect size of R=0.5 and statistical power level of 0.8, this study needs a minimum of
42 samples. Thus, the sample size of 42 respondents in the post-test is acceptable for
doing multiple regressions in this research.

First Layer of Multiple Regressions

Table 5.36: KSW related to CQ, CO and SE (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>443.884</td>
<td>3</td>
<td>147.961</td>
<td>2.57</td>
<td>.049</td>
</tr>
<tr>
<td>Residual</td>
<td>2073.491</td>
<td>36</td>
<td>57.597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2517.375</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>KSW</th>
<th>CQ</th>
<th>CO</th>
<th>SE</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30.506</td>
<td>8.246</td>
<td>.970</td>
<td></td>
<td>.001</td>
</tr>
<tr>
<td>CQ</td>
<td>.236</td>
<td>1.000</td>
<td>.543</td>
<td>.678</td>
<td>-.068</td>
<td>.147</td>
<td>-.103</td>
<td>-.462</td>
<td>.647</td>
</tr>
<tr>
<td></td>
<td>(.071)</td>
<td>(.001)</td>
<td>(&lt;.001)</td>
<td>(.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>.186</td>
<td>.543</td>
<td>1.000</td>
<td>.429</td>
<td>.080</td>
<td>.343</td>
<td>.042</td>
<td>.234</td>
<td>.816</td>
</tr>
<tr>
<td></td>
<td>(.125)</td>
<td>(&lt;.001)</td>
<td>(.003)</td>
<td>(.003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>.414</td>
<td>.678</td>
<td>.429</td>
<td>1.000</td>
<td>.538</td>
<td>.239</td>
<td>.466</td>
<td>2.250</td>
<td>.031</td>
</tr>
<tr>
<td></td>
<td>(.004)</td>
<td>(&lt;.001)</td>
<td>(.001)</td>
<td>(.003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Predictors: (Constant), CQ, CO, SE  
b Dependent variable : KSW  
c Significance (1-tailed) of Pearson Correlation are reported in parentheses
The path coefficients are $\beta$ weights (CQ = -.103; CO = .042; SE = .466) and the value of error variance is .907 ($e_{KSW} = \sqrt{(1-R^2)} = \sqrt{(1-.176)} = .907$). An ANOVA confirms that the regression equation is significant ($p < .05$). Moreover, only SE has a direct effect on KSW (SE = .466, $p < .05$); CQ and CO do not have direct effects on KSW because the correlations specified as causal effects are not significant (CQ = -.103, $p > .05$; CO = .042, $p > .05$). However, there are two indirect effects from CQ and CO on KSW because both CQ and CO are correlated with SE (CQ/SE = .678, $p < .01$; CO/SE = .429, $p < .01$) and SE can directly predicts KSW.

The path coefficients are $\beta$ weights (CQ = -.004; CO = -.142; SE = .119; KSW = .379) and the value of the error variance is .985 ($e_{KSB} = \sqrt{(1-R^2)} = \sqrt{(1-.028)} = .985$). An ANOVA confirms that the regression equation is not significant ($p > .05$). Moreover, there are no direct effects on KSB from any independent variables because all of the causal effects are not significant (CQ = -.004, $p > .05$; CO = -.142, $p > .05$).

### Second Layer of Multiple Regressions

The path coefficients are $\beta$ weights (CQ = -.004; CO = -.142; SE = .119; KSW = .379) and the value of the error variance is .985 ($e_{KSB} = \sqrt{(1-R^2)} = \sqrt{(1-.028)} = .985$). An ANOVA confirms that the regression equation is not significant ($p > .05$). Moreover, there are no direct effects on KSB from any independent variables because all of the causal effects are not significant (CQ = -.004, $p > .05$; CO = -.142, $p > .05$;
SE = .119, p > .05; KSW = .379, p > .05).

Table 5.37: KSB related to CQ, CO, SE, and KSW (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>111.364</td>
<td>4</td>
<td>27.841</td>
<td>.249</td>
<td>.908</td>
</tr>
<tr>
<td>Residual</td>
<td>3909.611</td>
<td>35</td>
<td>111.703</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4020.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>47.508</td>
<td>13.491</td>
<td>3.522</td>
<td>.001</td>
</tr>
<tr>
<td>CQ</td>
<td>-.003</td>
<td>.205</td>
<td>-.004</td>
<td>-.015</td>
</tr>
<tr>
<td>CO</td>
<td>-.340</td>
<td>.478</td>
<td>-.142</td>
<td>-.710</td>
</tr>
<tr>
<td>SE</td>
<td>.174</td>
<td>.356</td>
<td>.119</td>
<td>.490</td>
</tr>
<tr>
<td>KSW</td>
<td>.088</td>
<td>.232</td>
<td>.070</td>
<td>.379</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), CQ, CO, SE, KSW
b Dependent variable: KSB

Third Layer of Multiple Regressions

The path coefficients are \( \beta \) weights (KSW = -.100; KSB = .592) and the value of the error variance is .806 ( \( eMS = \sqrt{(1-R^2)} = \sqrt{(1-.350)} = .806 \)). An ANOVA confirms that the regression equation is significant (p < .05).

Table 5.38: MS related to KSW and KSB (post-test)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1614.923</td>
<td>2</td>
<td>807.461</td>
<td>9.952</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Residual</td>
<td>3002.052</td>
<td>37</td>
<td>81.137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4616.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>MS</th>
<th>KSW</th>
<th>KSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KSW</td>
<td>-.046(.390)</td>
<td>1.000</td>
<td>.092(.287)</td>
</tr>
<tr>
<td>KSB</td>
<td>.583(.000)</td>
<td>.092(.287)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>14.917</td>
<td>9.798</td>
<td>1.522</td>
<td>.136</td>
</tr>
<tr>
<td>KSW</td>
<td>-.135</td>
<td>.180</td>
<td>-.100</td>
<td>-.750</td>
</tr>
<tr>
<td>KSB</td>
<td>.635</td>
<td>.143</td>
<td>.592</td>
<td>4.448</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), KSW, KSB
b Dependent variable: MS
c Significance (1-tailed) of Pearson Correlation are reported in parentheses
Only KSB has a direct effect on MS (KSB = .592, p < .05); KSW does not have direct effects on MS because the correlations specified as causal effects are not significant (KSW = -.100, p > .05). Moreover, KSW cannot influence MS indirectly through the effect of KSB because KSW is not correlated with KSB (KSW/KSB = .092, p > .01).

**Figure 5.1: Portraying the full path model**

As described earlier in the full path model shown in Figure 5.1, the indirect effect of individual competences (CQ, CO, and SE) on MS cannot be found. CQ and CO have indirect effects on KSW through SE but cannot influence MS because MS only can be impacted by KSB as CQ, CO, SE, and KSW do not have any influential effect on it. Therefore, H7 is not supported, and this finding is different from the assumption made following literature review. It is important to find potential reasons to explain why there is a gap between this study and the relevant research. These issues will be discussed in more depth in Chapter 6 and Chapter 7.

**5.6 Summary**

This chapter firstly examined the quality of the instrument. Reliability and validity of measurements have been tested to show that the instrument used is of high quality for
This study then analysed demographic data and tested the quasi-experiment design, and the results showed that quasi-experiment design is applied suitably. Finally, the research hypotheses were investigated by using multivariate analysis with path analysis. The findings show that there are some gaps between the quantitative results and the literature review because most of the hypotheses proposed in Chapter 2 cannot be fully supported. Only Hypothesis 4 is supported by quantitative evidence, whereas Hypotheses 1, 2, 3, and 6 are partly supported and Hypotheses 5 and 7 cannot be supported.

The most important difference between the quantitative results and the literature review is that individual cultural intelligence, individual cultural openness, and self-efficacy can only slightly influence knowledge sharing willingness in a virtual team, but do not have an effect on knowledge sharing behaviour and member’s satisfaction. Exploring the potential reasons is necessary because only concentrating on the effect of individual competencies on a virtual team’s knowledge sharing and member’s satisfaction is not enough to answer why most of the hypotheses cannot be supported. Thus, this thesis will utilise a discussion of the qualitative approach to discuss the potential reasons and to explore other influential factors to explain the gap found from the quantitative data collected by surveys. Further discussions of the detailed qualitative data analysis will be presented in the next chapter.
Chapter 6: Qualitative Findings

6.1 Introduction
Chapter 5 has demonstrated the quantitative data analysis to investigate the hypotheses and shown some gaps between quantitative results and previous relevant research. This chapter intends to analyse those gaps by using a qualitative approach as it can provide more comprehensive explanations. Moreover, qualitative data analysis also assists to respond to the central question of ‘do those human factors have influential effects? Why or why not?’.

This chapter firstly explores influences related to individual competencies that are individual cultural intelligence, individual cultural openness, and self-efficacy respectively. It also explains the gaps in the quantitative findings responding Hypotheses 1 to 3. The discussion of why knowledge sharing within a virtual team has influential effects on a member’s satisfaction will then be investigated to explain Hypotheses 5 and 6. Based on qualitative data from the case study, the chapter will finally explore other potential factors that may significantly affect virtual teamwork.

6.2 Responding to Quantitative Results
6.2.1 The Effect of Individual Cultural Intelligence
As described in Chapter 5, Hypothesis 1 can only be partly supported, as it showed that individual cultural intelligence could affect knowledge sharing willingness but does not have any influences on knowledge sharing behaviour. In order to explain the gap between this quantitative finding and the existing literature, this research needs to understand the potential reasons behind the influences of individual cultural
intelligence.

As interviewees stated, people may be more willing to share their knowledge due to a better understanding of other cultures; nevertheless, this influence of individual cultural intelligence could be either remarkable or slight. Interviewee VN01 said that the understanding of other cultures influences her willingness to share knowledge and work with foreigners in virtual teamwork because she will have higher tolerance and more confidence to work with people from different countries if she has a good understanding of that culture (interview 1, 07 July 2011). While, another opinion that individual cultural intelligence only slightly influences individual knowledge sharing willingness is also mentioned. Interviewee AU01 stated that there are still some gaps between understanding and accepting dissimilar cultures, given that she is deeply involved in her own culture. Her willingness to share personal knowledge with another may be affected by the unacceptable feelings of the particular cultural background that the person comes from even though she understands the culture well (interview 7, 05 August 2011). From the evidence we can explain the quantitative result of hypothesis 1(a) because other factors could have more significant effects than cultural intelligence does on personal knowledge sharing willingness; for example, accepting culture has been mentioned as a more important element by AU01. Those important factors could occur during the period of virtual teamwork to influence the effect of individual cultural intelligence on knowledge sharing willingness.

For knowledge sharing behaviour, individual cultural intelligence could not have important effects because a member’s behaviour to share their personal knowledge in the virtual teamwork could be influenced by other factors more seriously. Although
interviewees VN01 and ID01 mentioned that people could work more actively with
team members from dissimilar cultural backgrounds if they have higher cultural
intelligence, some interviewees stressed that individual cultural intelligence is not the
key to influence their knowledge sharing within a virtual team because other factors
could have more important effects to affect such behaviours. For example,
interviewee AU02 said that her cultural intelligence only influences her willingness to
share knowledge but does not affect her behaviour because her interaction and
behaviour within a team will be impacted more seriously by other factors, such as the
team interaction (interview 8, 10 August 2011). Similarly, a clearer description is
stated by interviewee TW01 that

I don’t think my behaviour in the virtual team was influenced by my knowledge
about other cultures because I don’t really have a lot of knowledge about my
team members and their cultures as well. I think my behaviour is mostly affected
by the situation of team interaction and I didn’t participate in the activity very
often because my team members didn’t want to work in the team (interview 3, 11
July 2011).

From interviewees’ responses, Hypothesis 1(b) can be explained that team members’
knowledge sharing behaviour would be influenced more seriously by other elements
but not individual cultural intelligence.

As mentioned, it can be understood that individual cultural intelligence is not the vital
factor that influences both knowledge sharing willingness and behaviour because
other factors could be more important in affecting a virtual team’s knowledge sharing.
This finding is also relevant to the research proposition 1, that the effect of individual
cultural intelligence, one of the individual competencies, on a virtual team’s
knowledge sharing could be mediated by other influential factors. Thus, this study
tries to explore other potential factors later in this chapter.
6.2.2 The Effect of Individual Cultural Openness

The results outlined in Chapter 5 show that Hypothesis 2 cannot be fully supported. Based on the case study, we can find that individual cultural openness could or could not impact on individual knowledge sharing willingness; besides, it is not a key factor in influencing knowledge sharing behaviour within a team because team members’ cooperation will be affected more seriously by other important factors.

Some interviewees agree that people who have higher openness are more willing to share knowledge because their knowledge sharing willingness is influenced by their cultural openness. For example, interviewee VN02 mentioned that she is very willing to contact people from different cultures because she thinks working with foreigners can help her to get different viewpoints, thus, she is willing to share her knowledge with team members in the virtual teamwork (interview 2, 07 July 2011). Moreover, interviewee ID02 clearly explains that she is willing to share knowledge and work with people from other cultures because she is eager to know different cultures.

*I am willing to share my knowledge with people from other cultures because I am curious about their culture. I think they can give information about new things that I’ve never know before, and yes, it influences me much ...I willing to know and learn more because of the curiosity, and I don’t mind to share my opinion and my knowledge(interview 5, 18 July 2011).*

However, some interviewees stressed that individual cultural openness does not really influence their willingness to share personal knowledge within a team because they think working with people from other countries is different from contact with foreigners. Although they are willing to contact other cultures for fun, they may not want to share their knowledge and engage in virtual teamwork. For instance,
interviewee VN01 mentioned that the good understanding of team members is very important to her because she will feel a bit uncomfortable to work with others of whom she does not have enough understanding (interview 1, 07 July 2011).

interviewee VN02 also said that she is willing to contact other cultures but it does not really influence her willingness to cooperate with team members from different cultures because she thinks it is difficult to interact appropriately in the formal team cooperation (interview 2, 07 July 2011). While, interviewee TW02 has a similar opinion that

Doing tasks is different from contacting those people. I have to talk or react very carefully while collaborating with team members from different cultural background and this makes me very tired. Therefore, I am not so willing to share my knowledge and work in the virtual teamwork but I am very happy to contact other cultures, such as making friends with foreigners (interview 6, 23 July 2011).

The information above can explain Hypothesis 2(a) in that other factors could have a more significant influence on personal willingness to share knowledge, for example, the seriousness of formal teamwork has been mentioned as the more important element by interviewees. The effect of individual cultural openness on knowledge sharing willingness could be influenced by other factors appearing in the teamwork.

In the responses for Hypothesis 2(b), interviewees mentioned that their knowledge sharing behaviour is influenced by other important factors but not by individual cultural openness. Interviewee TW01 said that her cooperation in the virtual teamwork was seriously influenced by other factors, such as the interaction between team members and her English ability, but not by her cultural openness. ‘After I found it is very difficult to do the team task due to the lack of team interaction and my poor English skill, I decreased my participation in the virtual team activity’ (interview 3, 11
July 2011, student TW01). Similarly, interviewee AU01 stated that

*My cooperation with other team members is mostly influenced by the team interaction. If they (team members) actively participate and then I actively participate, if they don’t and then I don’t. It (my knowledge sharing behaviour and cooperation) is related with the team interaction, but not related with my personal thinking, knowledge, openness and so on (interview 7, 05 August 2011).*

From the interview data, it can be easily seen that individual cultural openness is not the key that affects team member’s knowledge sharing behaviour.

As described, we can find that the effect of individual cultural openness in the virtual team’s knowledge sharing, including both knowledge sharing willingness and behaviour, could be mediated by other influential factors, and this finding is related to research proposition 1. This chapter will discuss potential factors later, in section 6.3.

### 6.2.3 The Effect of Self-efficacy

Hypothesis 3, proposed in this study, is that the level of self-efficacy will positively influence a virtual team’s knowledge sharing, including knowledge sharing willingness and behaviour. Through the analysis of the quantitative data, this research found that self-efficacy can directly influence a team member’s willingness to share personal knowledge in the teamwork but does not have a major effect in improving their knowledge sharing behaviours. This finding shows that the investigation of Hypothesis 3(a) is consistent with the literature review; nevertheless, Hypothesis 3(b) cannot be supported so it is still a gap between the quantitative results and existing studies.

Individual knowledge sharing behaviour should be impacted by self-efficacy because
all interviewees mentioned that their cooperation behaviour in the teamwork will be influenced by their self-efficacy. If they have confidence, they will be more willing to actively share their knowledge in the team. For example, interviewee VN01 said that she will cooperate more actively and communicate more frequently with team members if she feels confident to work with those people, otherwise, she will avoid making the first move in the team if she does not have much self-confidence (interview 1, 07 July 2011). Similarly, some interviewees stated that their interactions in the team activity will be seriously impacted by their self-confidence. Interviewee AU01 said that she will be less encouraged to participate in the virtual teamwork if her English is not good enough because she would be afraid to communicate with other members (interview 7, 05 August 2011). Also, interviewee TW02 states that he will not actively interact with other team members due to low self-efficacy.

_I am not confident to work with foreigner because my language ability (English) is not good enough. It’s difficult for me to express my opinions or understand them (team members) so I will try to keep my interactions to a minimum level in the teamwork. For example, answering a question or giving my opinion rather than discussing_ (interview 6, 23 July 2011).

The information from interviewees outlined above can support the research assumption made following the literature review but cannot explain the gap of Hypothesis 3(b) found in the quantitative results. To explain why the effect of self-efficacy on knowledge sharing behaviour is not shown in the quantitative findings, this research argues that other factors could have more significant influences than does self-efficacy. The effect of self-efficacy alone is not strong enough to affect individual knowledge sharing behaviour in the teamwork. For example, other potential factors can affect team member’s knowledge sharing behaviour more seriously as an interviewee VN02 said.
I think self-efficacy only influences our (my and team member’s) cooperation sometimes. When we participate in this team, maybe they (team members) are confident to do the teamwork and share their knowledge but they actually don’t because they have different reasons. If I found some difficulties to participate in the team, I will reduce my participation in the teamwork as well (interview2, 07 July 2011).

In order to fully understand the influence of self-efficacy, this research needs to know why self-efficacy can affect virtual teamwork. A research proposition was developed in Chapter 3 that the effect of self-efficacy, one of individual competencies, on virtual team’s knowledge sharing could be mediated by other influential factors. The data collected through the case study can support this concept; hence, this chapter tries to find other potential influential factors, outlined in section 6.3, in order to lead further discussion in gaining a comprehensive understanding of virtual team framework.

6.2.4 The Effect of Virtual Team’s Knowledge Sharing

This research tested Hypotheses 5 and 6 to investigate the positive relationships between virtual team’s knowledge sharing and member’s satisfaction. Quantitative analysis shows that Hypothesis 5, the causal relationship between knowledge sharing willingness and behaviour, cannot be supported and Hypothesis 6, the positive effect of a virtual team’s knowledge sharing on a member’s satisfaction, can only be partly supported. By the use of case study, this research tries to explain those gaps.

In responding to Hypothesis 5, people could not share their own personal knowledge even though their knowledge sharing willingness is of a high level. Interviewees stated that individual knowledge sharing willingness has only a slight effect on individual knowledge sharing behaviour, e.g., the frequency of participating in the teamwork, because team members’ behaviour in the cooperation will be influenced by
many factors. Interviewee VN01 mentioned that knowledge sharing behaviour is uncertainly related with knowledge sharing willingness. For example, the task arrangement could be an important factor which affects the knowledge sharing behaviour in teamwork. If the team working style is such that each team member works independently and finally combine each other’s outcome as a whole completed work, it is unnecessary to contact and share knowledge with team members frequently (interview 1, 07 July 2011).

Moreover, interviewee ID02 stated that the nature of a project is a significant factor that influences her knowledge sharing behaviour within a team because she will more actively share her knowledge with team members if she feels that the project is interesting and needs her knowledge to be completed (interview 5, 18 July 2011). Similarly, interviewee AU02 stressed that her personal life is more important to her and this attitude will influence her participation for sharing knowledge in the teamwork.

Because sometimes we are busy and can’t do many things at the same time ... for example, you are busy to do other things in your personal life and you can’t focus on this kind of team task (interview 8, 10 August 2011).

Understanding that other factors, such as the task arrangement, the nature of project, and personal life, could be more important variables that affect individual behaviours in team cooperation; it can explain why knowledge sharing willingness does not show its significant influence on behaviours.

To respond to the quantitative results of the investigation of Hypothesis 6, it should concentrate on discussing the relationship between knowledge sharing willingness and a member’s satisfaction because Hypothesis 6(b), that knowledge sharing
behaviour influences a team member’s satisfaction, can be supported whereas Hypothesis 6(a), the effect of knowledge sharing willingness, cannot be supported.

Interviewees mentioned that a team member’s satisfaction is highly related with the team experience that they encountered but not with the individual knowledge sharing willingness. With higher knowledge sharing willingness, individuals could be more active in sharing personal knowledge in the teamwork but it does not mean that they can obtain new knowledge from team member’s knowledge sharing behaviour in return. For example, interviewee VN02 stressed that she could not have more communication with other team members and was confused to get ideas because her team members were usually doing other personal things but not the team task; as a result, she did not keep participating in the virtual teamwork and felt unsatisfied with the team cooperation (interview 2, 07 July 2011). In this case, people will not be satisfied with the team cooperation and outcome.

Unfortunately, most of the interviewees, AU01, TW01, and VN02, mentioned that they had a negative experience during the virtual teamwork. This situation can explain why individual knowledge sharing willingness cannot positively influence a team member’s satisfaction because personal satisfaction is significantly reduced by the negative teamwork experience. Hypothesis 6(a) cannot be explained well by using the quantitative results since other factors have not been explored. For instance, team experience, which can affect a member’s satisfaction more seriously than knowledge willingness, cannot be found in the quantitative data.

6.3 Exploring Other Potential Factors Influencing Virtual Teamwork

As discussed, individual competences cannot be considered as key factors which
affect a virtual team’s knowledge sharing and a member’s satisfaction, thus, it is necessary to investigate what other factors may impact on the virtual teamwork more significantly. In Chapter 3, this study made a research proposition that there are some other important factors that need to be discussed in the virtual teamwork, such as communication, trust, and leadership. By the use of a qualitative approach, this research found that communication style, interpersonal trust, and leadership are important elements that influence virtual teamwork; furthermore, other factors, such as team interaction, language ability, and technology, are also explored as influential elements that can affect team members’ cooperation in a virtual team.

6.3.1 Communication Style

All interviewees mentioned that they prefer face-to-face communication rather than contacting team members by using telecommunication when they are working in the teamwork; however, face-to-face meeting difficultly occurs in the virtual team environment. The lack of face-to-face communication will create some problems, such as conflicts within a team, misunderstandings between team members, and late responses in virtual team cooperation. For example, interviewee VN01 mentioned the main problem in the virtual teamwork is that transferring messages cannot be done immediately without face-to-face communication. She said that she prefers face-to-face communication because it is much faster and you get immediate feedback; by contrast, using a computer, such as email, it takes time and you cannot be sure that your team members have received the email or not; also you spend a lot of time waiting for the feedback (interview 1, 07 July 2011). Interviewee TW01 also expressed the same opinion about the importance of receiving an immediate response. A face-to-face meeting is more effective and efficient because this sort of communication happens simultaneously between team members. Team members do
not have to wait for a reply and can communicate with each other immediately. However, in the virtual team, the effectiveness and efficiency is not good enough if team communication relies only on email, chat room, and a discussion board (interview 3, 11 July 2011).

Thus, the lack of face-to-face communication could affect a team member’s willingness and behaviour to share personal knowledge within a virtual team. Interviewees, AU01, ID01, and VN02 stated that their willingness to participate in the virtual cooperation is reduced because there was no face-to-face meeting in the teamwork. For instance, interviewee VN02 said that it is difficult to engage in the virtual teamwork by using telecommunication and it really influenced her feelings about sharing personal knowledge because it takes a lot of time for the communications and discussions (interview 2, 07 July 2011). Interviewee AU01 stated that the lack of face-to-face communication discouraged her to share personal knowledge because she always waits for team members’ responses and she thinks it is an inefficient working style (interview 7, 05 August 2011).

### 6.3.2 Interpersonal Trust

Interpersonal trust is assumed to be another important factor that influences the team cooperation significantly, as outlined in Chapter 3. All interviewees mentioned that their willingness to share knowledge with team members will be impacted by how much they trust other members. For example, interviewee VN01 said that she does not want to share personal knowledge with other team members if she does not trust their ability to finish the task (interview 1, 07 July 2011). Interviewee VN02 mentioned that she will only share her knowledge with those whom she trusts because she will have confidence in their behaviour (interview 2, 07 July 2011). Similarly,
interviewee TW02 stated that interpersonal trust is the basis for team cooperation.

If I don’t know someone, I won’t trust him/her too much so I won’t to share too much information and personal knowledge with strangers. I will share knowledge with someone I trust because I know he would share his knowledge just like what I do and that’s good for us to learn more (interview 6, 23 July 2011).

However, building interpersonal trust in the virtual teamwork is very difficult due to the lack of physical contacts so it can be a big problem for discouraging a team member’s interaction within a team. For instance, interviewee TW01 mentioned that she feels a little bit uncomfortable to share personal knowledge in the virtual team because she does not know her team members well; thus, she will avoid discussing anything in-depth with virtual team members and getting involved in the team activity much if she feels the interaction between members is not good enough (interview 3, 11 July 2011).

6.3.3 Leadership

The team interaction and cooperation can be influenced by the leadership behaviour. Interviewees mentioned the importance of a team leader as a significant factor which affects team member’s willingness to share knowledge because they believe a team leader can allocate jobs and solve problems that occur within a team. Interviewee VN02 mentioned that she would communicate more actively with team members if there was a leader in the virtual team because a team leader can enhance the communication between team members, connect each member, and obtain the solution (interview2, 07 July 2011). Similarly, interviewee TW01 stressed that if there was a good leader in the virtual team, she would be more willing to share personal knowledge because she believes that the leader can control team interaction well and
solve any problems, such as conflicts between members (interview 3, 11 July 2011).

Team performance can be influenced by the leadership behaviour because the leader can guide team members to work together to achieve a common goal. The team leader has authority to control teamwork so that making decisions would not be too difficult in the virtual teamwork. For example, interviewee TW02 mentioned that the leader is important because he or she can control the progress of tasks and organise the opinions provided by members; also, the leader can mediate or make a decision whenever a dispute happens because of his or her authority (interview 6, 23 July 2011). Interviewee AU01 stated that the team leader could organise and summarise all team members’ ideas so that teamwork would be more effective and efficient; otherwise, there was no result and no conclusion in the virtual teamwork at all (interview 7, 05 August 2011). To conclude, the important influence of leadership in the virtual teamwork is emphasised.

6.3.4 Team Interaction

All interviewees mentioned that team interaction is the most significant factor that influences their behaviour to cooperate in a team because the team experience they have encountered may directly affect their individual ability (e.g. self-efficacy) and attitude (i.e. willingness) to participate in the virtual teamwork. For example, interviewee VN02 said that she lost touch and keeping in contact with team members because her team members did not frequently participate in the teamwork, and the lack of interaction with team members made her confused and frustrated about continuing doing the virtual team activity (interview 2, 07 July 2011). Interviewee AU01 also emphasised that the team interaction is important in influencing her knowledge sharing willingness and behaviour in the virtual teamwork. The interaction
with team members should be the basic requirement for the teamwork but her team did not have it. Hence, she became unwilling to participate in the team because she felt that her team members were not willing to do the task so that her passion was reduced by the others’ reaction and she felt frustrated as well (interview7, 05 August 2011).

Similarly, interviewee ID01 said that not all members were actively participating in the virtual teamwork and she sometimes felt bored because, while she shared her knowledge, she could not get much feedback, and this situation made her feel lazy sometimes in sharing her personal knowledge (interview 4, 18 July 2011). Interviewee TW01, however, addressed that her willingness and behaviour to share knowledge and participate in the virtual team activity was seriously impacted by the poor response from team members.

Some of my team members haven’t replied any opinions on the discussion board. Late reply was common during the period of my virtual teamwork. I didn’t want to participate in the virtual teamwork frequently because I know that my members wouldn’t discuss on line very often. I couldn’t learn things and gain knowledge from others even though I worked hard. It seems to me that just wasting my time to do this job. I think getting the feedback from other team members is very important to keep running the team corporation (interview 3, 11 July 2011).

6.3.5 Language Ability

Participants’ language ability with English is another important factor that affects team members’ willingness and behaviour in the virtual teamwork. All interviewees mentioned that their English ability influenced their self-confidence to work and communicate with team members from different countries in the virtual team; and finally, their cooperation in the team will be impacted by their English ability. For
example, interviewee TW01 clearly explains the importance of language ability, English, in influencing individual self-efficacy and willingness to share knowledge based on her virtual team experience.

*My English ability seriously affects my willingness to work in this virtual team. At the beginning of this activity, I thought I could work with my team members well because I only need to communicate by reading and writing and also have time to consider how to response others’ opinion. However, it was not easy as my image, I couldn’t understand documents and what my team members posted in the discussion board very well and must check dictionary all the time. Moreover, I need to spend time for my writing since the English gramma is so different from Chinese. I felt so tired to do such things and finally didn’t want to pay too much attention in the team task (interview 3, 11 July 2011).*

### 6.3.6 Technology

As mentioned in Chapter 2, this research concentrates on investigating the effect of the human factors in the virtual team but not the technology aspects. However, the technology aspect is certainly an influential element because technology is crucial in supporting a successful virtual teamwork. All interviewees mentioned that the internet connection must be good enough to support the team working in the virtual environment. If there are always access problems in virtual teamwork, they will not be willing to actively participate in the virtual teamwork. Interviewee VN01 said that the condition of the internet connection impacts on her willingness to work in the virtual team because it is annoying if the connection is not good enough and she does not want to continue the conversation unless the connection is getting better (interview 1, 07 July 2011). Also, interviewee TW01 stated that she would not do virtual teamwork frequently if the internet was often disconnected because this kind of problem would cost her more time to do the task and really annoy her (interview 3, 11 July 2011). Similarly, interviewee ID02 stressed that it is necessary to have a high-speed connection with internet access because the internet is the basic
infrastructure for the good communication in a virtual team (interview 5, 18 July 2011). While, interviewee AU01 mentioned that if there were internet connection problems, she did not want to do this activity anymore because she would feel stressed and frustrated doing it (interview 7, 05 August 2011).

6.4 Summary

Through the use of a case study, this chapter tries to understand the effect of observed human factors on virtual teamwork, and the potential reasons behind those influences, to explain why the quantitative results are different from relevant studies. Qualitative data analysis shows that individual competencies are not key factors which affect a virtual team’s knowledge sharing and a member’s satisfaction because other potential factors could have more significant influences on virtual teamwork. The effects of the observed human factors could be mediated or intervened by some influential factors, so it is necessary to find those potential factors. Based on the case study, this chapter explored how communication style, interpersonal trust, leadership, team interaction, language ability, and technology have serious influences on virtual teamwork. However, the reason why those factors can appear to have a more important effect than the human factors investigated has not been discussed in the study. This research will argue that the use of a new approach to the investigation of virtual teamwork distinguishes this research from existing studies, thus, the different findings can be explored. In the next chapter, three arguments will be presented to discuss the new research findings and a virtual teamwork model will be proposed by combining both quantitative and qualitative data.
Chapter 7: Discussion

7.1 Introduction

Previous chapters investigated the relationships between human factors and virtual team cooperation. It was established that other elements influence virtual teamwork in a cross-national environment besides human factors identified at the beginning of the research. This chapter discusses the research findings of both the quantitative and qualitative data to provide a better understanding of the virtual teamwork in the context of cross-national boundaries.

The chapter firstly stresses the impact of a virtual working environment and its importance in terms of creating different working styles from existing studies, which investigated face-to-face teams. It then emphasises the influence of a member’s team experiences on virtual teamwork. The understanding that interaction between team members can impact on virtual team cooperation directly and immediately is also a crucial finding in this research. Finally, this chapter argues this cross-national research investigation is more complicated than if it was in a single location because the virtual teamwork can be impacted by many potential factors due to the different geographical locations between members. The chapter finally constructs a new virtual team model that can be used in the cross-national environment.

7.2 Interrelation between the Working Environment and Virtual Teamwork

One explanation of the new findings explored in the study is that in the virtual team working environment team members’ working style might be quite different, which can hamper cooperation. Business success relies highly on the processes through
which team members interact and collaborate with each other (Kearney et al., 2009). In conventional face-to-face teamwork, members can easily understand each other by observing each others’ behaviours, and they are more willing to cooperate within a team if they trust other team members. By contrast, in the virtual team environment, developing trust between team members is problematical as virtual team members may never have met each other, and it is difficult to assess a team member’s trustworthiness without physical contact (Powell et al., 2004). It is arguable that the nature of the working environment can be a significant element affecting virtual teamwork, as the operating style of a virtual team as opposed to a conventional team can create some difficulties for communication in the virtual team cooperation.

7.2.1 The Nature of Working Environment in Virtual Team

The virtual teams investigated in the research are all self-managed teams where members work together by using telecommunication without any physical contacts and team leaders. Virtual team members’ attitudes toward sharing knowledge in a team can be seriously influenced by the feelings of social isolation because the virtual teamwork is relies highly on the use of Computer Mediated Communication (CMC), and teams cannot collaborate in face-to-face meetings. All interviewees agree that communication style is an important factor influencing virtual team members’ cooperation, because face-to-face conversation is still regarded as the most effective and efficient communication style. This finding is similar to the assumption made in Chapter 3, that the communication style used in the virtual team can affect individual psychological feelings about contacting and collaborating with other team members.

Working in the virtual environment may produce some problems in team cooperation. For example, interpersonal trust, an important factor which influences teamwork, is
extremely difficult to develop in the virtual environment because building trust between team members strongly requires physical contact and developing long-term relationships. Interviewees shared their virtual teamwork experiences, that it is a real challenge to build trust in a virtual team by only using telecommunication.

Interviewee VN02 recalled the cooperation in her virtual team and said that

> In my view, building the interpersonal trust between team members is very important, however, in the virtual team environment, I think it is really challenge to build trust within a team by using computer-based communication only (interview 2, 07 July 2011).

After working in the virtual team activity for several days, participants did not get to know other team members well due to the lack of physical contact so that they could not develop trust in other members. As mentioned by interviewee TW01, she avoided discussing in-depth or sharing too much personal knowledge with her virtual team members because there was no ability to develop interpersonal relationships in her virtual team (interview 3, 11 July 2011). It is difficult to engage the cooperation of team members in a virtual team because interpersonal trust, which aids collaboration between team members, cannot be built successfully during a short period of teamwork in a virtual working environment.

The difficulty of building interpersonal trust suggests that having a team leader and clear rules to guide members is a significant requirement for successful virtual teamwork because the trust between virtual team members can be more quickly developed through making rules and developing norms. Some interviewees stressed that they would actively cooperate in a virtual team if the team is well organised and controlled by norms which define acceptable behaviour. They believe that other members are more likely to perform positive behaviours towards the teamwork by
following working rules, for example, interviewee TW02 stated below

I prefer to work in a well-controlled virtual team by making clear norms and rules because every team member is required to contribute for completing team task and this would make me want to share more knowledge in the teamwork due to the feeling about fair and safety (interview 6, 23 July 2011).

However, the virtual teams investigated in the study were all self-managed teams, as the research investigator could not easily control and manage team operation in the cross-national working environment. The lack of guidance and advice provided by a team leader can influence a virtual team participant’s individual feelings and attitudes towards cooperating in the teamwork, as some interviewees emphasised that a team leader is essential to control team interaction and resolve communication problems. Interview respondents stated that they would be more like to actively communicate and share personal knowledge with other team members if there was a leader of the virtual teamwork, because the team interaction could be improved and activated by the leader’s behaviour. Yet, there was no leader in their virtual teams. Team cooperation and interaction were not well-controlled, so they were confused about what steps they should take next to complete the task, as mentioned by interviewee TW01 that

I believe that team leader plays an important role for controlling team interaction. Based on my experience in this virtual team activity, I think the team leader is more important in the virtual teamwork because team members were not organised well to do the team task. We did not know what we should do in next steps and always waited for someone else to act first in the team interaction (interview 3, 11 July 2011).

This feeling of uncertainty influenced the individual attitude to share knowledge and cooperate with others in the virtual teamwork. As the lack of a leader could create confusion in the team’s interactions, virtual team members could not collaborate well
in virtual self-managed teamwork.

7.2.2 Computer-based Communication in Virtual Team

Communicating with other team members through the use of computer-based technology can create many difficulties for effective communication in team cooperation. Without face-to-face conversations, team members could not understand each other or be involved in the teamwork easily. Employing computer-based communication, as the main method for team cooperation, could influence virtual team members’ willingness to collaborate and share personal knowledge with others in the teamwork. Some interviewees emphasised that they are not willing to participate in a virtual team because there would be no face-to-face meetings and this situation could create communication problems in the team. For example, interviewee VN02 said that she could not feel really engaged in the virtual teamwork because it was very hard to discuss team tasks with other members due to there being no face-to-face communication (interview 2, 07 July 2011). Interviewees stressed that they prefer face-to-face rather than computer-based communication method to contact other team members because they communicate more effectively through the use of body language, such as making eye contact, gestures, and facial expressions. As stated by interviewee AU02

*Even though telecommunication can help us contacting with team members in different locations, it is still difficult to understand each other, for example, although we use telephone for conversations, we could not understand the accent, but in face-to-face communication, we can guess what others trying to say from their facial expression and body language* (interview 8, 10 August 2011).

In comparison with the use of face-to-face meetings, virtual team members felt that they could not explain their ideas and opinions clearly and effectively by utilising
computer-based communication. Interviewee VN02 shared her virtual teamwork experience that using telecommunications cannot clearly explain her feelings and ideas; she sometimes did not understand the messages from her team members (interview 2, 07 July 2011).

Many problems, therefore, occurred in virtual team cooperation, including misunderstanding, late responses, and no feedback, due to there being no face-to-face communication in the teamwork. Interviewee AU01 stressed the difficulty of cooperating in the virtual environment that

> In the virtual teamwork, we only relied on emails, and did not have face-to-face meetings. I think the lack of face-to-face communication making the inefficient work style and I sometimes felt that my team members could probably not feel the responsibility for doing the job in the virtual environment so that I always needed to wait for their responses (interview 7, 05 August 2011).

Virtual team members who have high individual competencies could not perform well in virtual team cooperation because using computer-based communication only is not an effective and efficient method for transferring knowledge in the team.

Relevant to the discussion of computer-based communication in the virtual working environment is that the importance of technology should be emphasised because technology must support effective communication between team members. Virtual team members’ willingness and cooperation will otherwise be limited. For example, team members will not keep participating in the team activity and will not be willing to collaborate if they have experienced many technical difficulties while making contact with other team members. Interviewee AU02 stressed the significance of technology in working in a virtual environment saying that she will be not willing to participate in virtual teamwork if she does not have broadband at home or the internet.
always disconnected (interview 8, 10 August 2011).

Supportive technology is highlighted for a successful virtual team. If virtual team members cannot be supported by good quality information technology, they cannot perform team tasks well and share their knowledge in the team even though they have outstanding individual competencies for working in such an environment. Several interviewees who live in developing countries have emphasised the difficulty of internet connection as an important problem that impacts on their cooperation in virtual teamwork. Interviewee ID01 stated that the quality of internet in Indonesia is not good enough to support effective virtual team cooperation such that

Yes, the internet connection is a problem; sometimes the server cannot get access in Indonesia. The quality of internet is sometimes poor, slow, very very slow. If we need to do the work by the internet phone or teleconferencing, yeah, it will be a trouble (interview 4, 18 July 2011).

Similarly, interviewee VN02 mentioned her willingness to do the virtual team task was decreased by the internet connection problem such that

I remember the first time for log in the online working environment, it takes ages to connect the internet and log in the RMIT Blackboard, Yeah, it is a problem. I finally abandoned to participate in the virtual team activity because I felt uncomfortable and I found it is hard to get access to other people (interview 2, 07 July 2011).

Technology can moderate the influences of individual competencies on knowledge sharing within a team. As mentioned above, interviewees’ participation in the virtual team activity was significantly impacted by the quality of their internet connection. They sometimes could not access the virtual team to do the task and this problem was the main reason that reduced their cooperation with other team members. Therefore, the importance of technology cannot be ignored in constructing virtual team framework in a multinational environment because the positive effects of the human
factors that impact on team cooperation can be obviously intervened by technology influences.

7.3 Member’s Team Experiences and Virtual Teamwork

Another explanation of different results on the effects of human factors is the team interaction that team members have experienced in their virtual teamwork. As presented in Chapter 4, this study applies quasi-experiment design with two-staged surveys, pre- and post-test, to collect quantitative data. This study found that team members’ individual competencies to deal with cultural diversity were changed during the processes of virtual teamwork. This phenomenon of changed human factors has not been discovered in previous studies owing to their using a snapshot examination. From the qualitative data, this research finds that the fundamental reason behind changed human factors is the influence of members’ experiences with the teamwork. It can be understood that their experience of team interaction is the crucial factor which affects individual attitudes and feelings to cooperate with other team members, because a person’s willingness will be adapted by the team interaction he or she has encountered. The next sections discuss the influences of members’ team experiences on virtual teamwork by analysing the interrelation between team interaction and human factors, and how it impacts on team cooperation.

7.3.1 Members’ Experiences and Individual Competencies

Team members’ individual competencies to work in a cross-national team will be influenced by their previous experiences of coping with different cultures. From the qualitative data it can be seen that people may have higher individual cultural intelligence if they have more experience of communicating with foreigners and have had contact with people from different cultural backgrounds, because they can acquire
knowledge from those valuable cross-cultural experiences. As mentioned by interviewee ID01 that having friends from other countries is important in enhancing her cultural intelligence

*I have a lot of knowledge about other cultures because I have friends from different countries and we share knowledge about each other’s characteristics (interview 4, 18 July 2011).*

Interviewee AU01 stated that studying overseas improves her knowledge about different cultures in that

*I have more knowledge about Australian culture because I am studying in Australia. I understand what Australian’s behaviour will be, for example, the way they act is different from my own culture (interview 7, 05 August 2011).*

Individual cultural openness will also be influenced by personal cross-cultural experiences. A person’s openness to other cultures may be higher if he or she has more positive cross-cultural experiences, such as pleasurable overseas travels and a good relationship with foreigners. Interviewees mentioned that their previous cross-cultural experiences positively influenced their willingness to contact other cultures. For example, interviewee VN01 recalled her positive experience, saying that studying in Australia significantly affected her openness to other cultures. She felt that she has a much better understanding of other cultures because Australia is a country that contains multiple cultures and she was frequently in contact with people from different countries when she studied in Australia. As this knowledge helped her to understand cultural differences, her tolerance for the differences was much higher and she realised that it is better to be open to the different cultures (interview 1, 07 July 2011). Conversely, it can be assumed that individual competencies for dealing with different cultures can also be reduced by negative cross-cultural experiences. People who have more negative cross-cultural experiences may be afraid of contacting people from other different cultures due to the unpleasant experiences they have
encountered. Thus, the positive relationship between members’ previous experiences and individual competencies can be presumed.

An individual will be more willing to work in a team if he or she has positive experiences with teamwork. For example, interviewee AU02 pointed out that she prefers to work with westerners rather than with Asians when doing a course assignment as a team. Based on her previous teamwork experiences with different workgroups, she thinks westerners have many ideas and are very active participants in group work; by contrast, Asians are more likely to be shy about providing their opinions in the team. Thus, her willingness to work with Asian students in a team has been influenced by this negative feeling (interview 8, 10 August 2011).

Since many virtual team participants have stressed that working in the virtual team has mainly brought them negative experiences, it is unsurprisingly that mainly virtual team participants’ individual competencies and willingness has been reduced. Three out of four interviewees who have participated in the virtual team activity, said that they were not satisfied with the virtual teamwork because it was mostly a negative experience (AU01, TW01, and VN02). They emphasised that the lack of team interaction is a big problem for the team cooperation when they were participating in the virtual team activity. For example, interviewee AU01 complained that her virtual team members,

*Late response and not many team members response are often happened in my virtual teamwork. Sometimes I thought I was doing it alone and was wondering why there were no response. Where were my team members? Were they in the vacation? (interview 7, 05 August 2011).*

After working in the virtual team activity, members developed some negative feelings
because they were getting confused and doubted themselves whether they really understood team members who were from different cultures. The negative experience with the team interaction makes team members re-think and re-evaluate their understanding of other cultures so that individual cultural intelligence has been changed, and has mainly decreased, as mentioned by interviewee TW01 below,

*I thought I have some knowledge about other cultures before participating in the virtual team. However, I found that I might not know other cultures as much as I thought after working in the virtual teamwork because I sometimes could not really catch the main point of my member’s opinions and views. Moreover, there was the lack of collaboration from other team members within a team. I get confused and think that I may not know much about other cultures* (interview 3, 11 July 2011).

Besides, team members’ willingness to make contact with other cultures in the future is decreased by their disappointing virtual team experience, as they were felt considerable anxiety about the situation of why other team members did not respond to their comments and why there was a lack of cooperation. The negative team experiences can result in bad feelings of being open to working and contacting people from different cultures in the virtual team. For example, interviewee TW01 stated that her willingness to do virtual teamwork is seriously influenced by the poor interaction between members as follows

*I am happy to contact other cultures if I have any opportunities because my previous experiences with other cultures are good. At the beginning, I was very willing to participate in the virtual team activity because I thought working with foreigners is interesting. However, after few days working, I felt so exhausted and frustrated and not willing to working with others anymore because some of my team members either have not replied any opinion or always late reply* (interview 3, 11 July 2011).

Team interaction should be proposed as the most important factor affecting cross-national virtual teamwork because it can directly influence individual attitudes
toward working in a virtual team. As emphasised by interviewee TW01, she is afraid of participating in other virtual teams if they are cross-national virtual teams and she thinks it is not a good idea to contact unfamiliar cultures in the virtual environment due to her negative virtual teamwork experience (interview 3, 11 July 2011).

7.3.2 Team Interaction and Knowledge Sharing

As mentioned earlier, poor team interaction can produce negative working emotions between team members, which then, impact on team members’ feelings and attitudes to communicating with others. The negative virtual team interaction, such as late responses and team members’ absence, may also impact on the individual willingness and behaviour to share personal knowledge with other members.

All interviewees stated that they are willing to share personal knowledge in the team only if their team members are also open to sharing because no one wants to contribute without any gain in return. Unfortunately, the team interaction was not good enough when they were working in the virtual team activity, as most of the other members were not really involved in completing the team task. Thus, they finally realised that sharing personal knowledge in such teams would be a bad idea. For instance, interviewee ID01 said that,

*Only one or two team members were actively sharing their knowledge in the virtual team activity. It influenced me to share mine because it means I only share my knowledge but cannot get many feedbacks (interview 4, 18 July 2011).*

Without obtaining new knowledge in return, people are not happy to contribute their own personal knowledge when working in a team because they think it is an inappropriate behaviour due the unfair feelings.
With the decreased willingness to collaborate with other team members, virtual team members reduced their participation and discussions in team cooperation. From the investigator’s observation, some virtual team participants communicated more actively with other team members at the beginning stage of the teamwork; however, they did not keep participating often after they found that other team members were not responding much. Moreover, some virtual team members have shown their disappointment about the team interaction in the discussion forum and asked other team members to participate and share opinions about completing the team task, as the observation record for 26.03.2011 shows below:

Hi mates, we need to start discussing our selection as soon as possible. Until now, I have not received any reaction from you guys; I really please you not to be silence any more. We need to talk, we need to share, and we need to communicate (Observation record of virtual team activity, group 9, on 26.03.2011).

Many virtual team members continued to complain and report that the lack of team interaction did not improve during the whole process of teamwork, and therefore, they finally decreased the frequency of sharing personal ideas online in the virtual teamwork. The records of problem reports show the evidence as follows:

The main problem for our teamwork is the communication between members. It is difficult to get other members’ idea and all I could do is trying my best to motivate my group mates. However, it looks like not working well (Record of problem report, group 9, on 28.03.2011).

There were no replies from other team members. Some team members haven’t even bothered to introduce themselves so it is really hard to discuss opinions or get anywhere with the task on hand when nobody knows each other. The real lack of communication between team members is big problem (Record of problem report, group 4, on 28.03.2011).

Other 3 team members have not advised their opinions and it has been hard to
get communication from 3 of the team members (Record of problem report, group 5, on 31.03.2011).

Based on the above descriptions, it can be easily seen that team members’ cooperation behaviour within a team is significantly affected by the situation of team interaction. Virtual team members will reduce their collaborating actions, including knowledge sharing behaviour, within a team if they are experiencing poor team interaction. Good team interaction is essential and a basic requirement for teamwork because virtual team members only want to work and share knowledge in a team if other team members perform the same cooperating behaviour, due to the equitable principle. Consequently, it is undoubtedly that team cooperation and knowledge sharing between team members can be seriously impacted by the poor team interaction, therefore, the experience of team interaction is a vital factor that can directly and immediately impact on virtual teamwork.

7.4 Multinational Locations and Virtual Team Operation

Research investigation in the cross-national environment allowed this study to explore new findings that have rarely been discussed in previous literature. Four locations including Australia, Indonesia, Taiwan, and Vietnam have been selected to conduct the quasi-experimental design and case study. Cross-national communication and management in dealing with the different national backgrounds of members appears to be a vital factors in influencing virtual team collaboration. Moreover, the diversity of the various nations’ situation, such as the country’s infrastructure, needs to be considered as a potential factor that affects virtual teamwork, because team members from different geographic locations are working together. This section, therefore, provides two explanations of how the multiple nations locations from which team
members come can influence virtual teamwork. Firstly, the different individual abilities and attitudes that have developed through the disparate learning and educational processes could impact on the cooperation between members in the team. Secondly, the diversity of each nation’s economic development is discussed because the development of information technology in the country, such as telecommunication infrastructure, can positively influence virtual team operation.

7.4.1 Various Individual Ability and Attitude

This study finds that language ability, namely ability in the English language, is an important element which affects team members’ cooperation in a virtual team, because communicating in English is the basic requirement for working in the cross-national environment. A person’s language ability can significantly affect the individual’s self-confidence to work with team members of different nationalities; further, this can, influence members’ willingness to cooperate within the team. One of the research findings shows that team members’ self-efficacy is seriously decreased after working in the virtual team activity. All interviewees agreed that their self-confidence in contacting and communicating with other team members from different countries will be influenced by their own level of English language ability. People will have more self-confidence to work in a cross-national virtual team if they believe that having conversations with other team members in English would not be a problem for them. Therefore, the level of self-efficacy will be highly related with the level of English ability, as mentioned by interviewee VN01,

If I am confident with my English, it would not be a problem to work with members from other countries. However, if I think my English is not good enough, I would not be confident to work and communicate with them because some problems, like misunderstanding, could be happened (interview 1, 07 July 2011).
It can be seen that interviewees from Australia and Vietnam are more confident in their language ability. Interviewees AU01 and VN01 stated that they are willing to work with people from different countries, either in a conventional team or in a virtual team environment, because they are confident in their English ability (interview 7, 05 August 2011; interview 1, 07 July 2011). By contrast, Taiwanese interviewees have lower confidence in their English ability because the English language is completely different to Chinese in writing script, phraseology, grammar, and sentence structure. They indicated low self-efficacy because they are not confident in their English ability and they are afraid that other team members would not understand them very well in the team. For example, a Taiwanese virtual team member showed her nervousness about English in an online discussion forum,

Hello, all: My name is ... I am from Taiwan and now studying in DYU, Taiwan.... I hope we can complete the virtual team together. Good to meet you, my colleagues.... I'm not very good in English, please forgive me, thank you.”
(Observation record of virtual team activity, group 9, on 30.03.2011).

Similarly, interviewee TW01 also emphasised that her self-efficacy has been decreased seriously after participating in the virtual teamwork. Since she has found that it was extremely difficult to communicate with other team members successfully because of her poor English ability, her confidence to work in the cross-national team is remarkably decreased (interview 3, 11 July 2011).

The frustrating experience with English communication creates team members’ negative judgments about their personal ability to work in the cross-national virtual team. As the language ability can influence individual judgment and attitude in working in the virtual team, it can impact further on personal cooperation behaviours
in working in the team. Interview respondents mentioned that they could obviously see that some of their virtual team members have a low level of ability in English or confidence in English communication so those members finally decreased their participation markedly, even left the discussion on the forum in the virtual team. Interviewee AU01 supposed that some of her team members were struggling to do some of the team tasks because of their lack of English ability. She said,

Based on my virtual team experience, some member just participate once or twice and then disappeared. I guess they are losing their self-confidence in communicating with people by only using English. For example, by reading their (team members) writing, you can see that some member’s English is not good enough and they don’t have confidence in English ability (interview 7, 05 August 2011).

Interviewee ID01 had the same opinion as interviewee AU01 and stated,

I think self-efficacy will influence on team cooperation because several of team members are not confidence enough, from their writing you can see that they are shy in English and they finally leave the conversation on the online discussion forum (interview 4, 18 July 2011).

Moreover, interviewee TW01 also stressed that her willingness and behaviour to cooperate with other members had been seriously influenced by her English skills because she felt very exhausted and frustrated doing the team task without a good ability in English, and she often did not want to continue participating in the virtual teamwork (interview 3, 11 July 2011).

People will be afraid of communicating with others from different nations if they do not meet the required individual ability, such as language ability, for overcoming cross-national communication. Eventually, they will lose self-confidence in working in a cross-national virtual team and which could reduce their willingness and participation to do the team task. The phenomenon that the various individual abilities
and attitudes influence team cooperation can be found in this study because most of virtual team participants in this research project were not English native speakers and some of them do not have a good ability in English to communicate with team members from different countries.

7.4.2 National Telecommunication Infrastructure

The developments in information technology are at different levels in Australia, Indonesia, Taiwan, and Vietnam. Australia is classified as one of the developed countries and the national telecommunications infrastructure has been constructed well. The Australian government has increased the investment in the development of telecommunications infrastructure and the penetration of internet usage has reached 89.8% of population as at 31 December 2011 (Internet World Stats, 2012a). The Taiwanese government plays an active role in supporting technology development within the country, and the total broadband penetration in Taiwan has increased to around 95%, including both fixed line and mobile (Internet World Stats, 2012b). More than 70% of the population in Taiwan are internet users, because 65% of Taiwanese homes have fixed-line broadband connections and 90% of homes own PCs (Hulme-Jones, 2011).

Compare to the two countries above, the national telecommunications infrastructure in Indonesia and Vietnam is less developed. Indonesia is a country comprised of about 17,500 islands so it is difficult to build the telecommunications infrastructure successfully due to the complicated geography. Until the end of 2011, the penetration of internet use in Indonesia was still low, about 22.4% of population (Internet World Stats, 2012b). Whereas, Vietnam has come late to the development of information technology, the internet and broadband market have started to grow ‘but broadband
remains on a relatively small scale and in need of a stronger market focus by the providers’ (Evans, 2012). The penetration of the internet users within the country is only around 33.7% as at the 31 December 2011 (Internet World Stats, 2012b).

There are, therefore, some problems for Vietnamese and Indonesian members to participate and collaborate in the virtual team work. Two interview respondents, VN02 and ID01, mentioned that some internet connection problems happened when they were trying to do the virtual team task, and this situation affected their willingness to continue cooperating in the teamwork (interview 2, 07 July 2011; interview 4, 18 July 2011). The telecommunication infrastructure in the locations where team members live must be developed well in order to support the virtual team operation; otherwise, virtual team members cannot work with others from different countries because using telecommunication is the only method to contact with each other. A Vietnamese virtual team member reported that the difficult of accessing the internet is the main problem for gaining the cooperation of many Vietnamese’ in the teamwork,

I'm a member of virtual team 3 from Vietnam. However, there's a problem happening with network that we couldn't log in to Melbourne website, library, learning hub or whatsoever. I think that is one reason why we could not communicate very often these days and I think it happens with others in Vietnam too (Record of problem report, group 3, on 31.03.2011).

From the discussions above, it can be understood that the different national telecommunication infrastructures would be a potential factor in influencing virtual team cooperation, because members’ willingness and ability to collaborate with others in a team will also be impacted by how supported they are by their external environment. The effect of national telecommunication infrastructure on virtual teamwork is a significant result in this study, because the research investigation is in
multiple national locations that contain developed and developing countries.

Figure 7.1 shows how the above mentioned three arguments support the new results found in the study in response to the theoretical framework demonstrated in Chapter 1. Firstly, the differences of the working environments between conventional and virtual team is an important element in influencing the relationship between individual competencies and the virtual team’s knowledge sharing, because virtual team members’ cooperation can be significantly impacted by the lack of physical contacts, which can produce some problems in the teamwork. Secondly, by studying the process rather than a snapshot of virtual teamwork, this research found that the individual competencies and attitudes for sharing knowledge in a team can be influenced by the individual’s experiences of team interaction. Also, other factors could appear to affect team cooperation during the processes of teamwork. Thirdly, virtual teamwork in this research is under different conditions from those in previous studies, that of working in a cross-national environment, not a single location. Working in a virtual environment makes the teamwork more complex, because team cooperation could be affected by various situations, such as the national telecommunications infrastructure. The following section discusses the influences of explored potential factors on virtual team cooperation in order to construct the new model of virtual teamwork.
Figure 7.1: Contribution of the study

Research Background & Environment

Early 1980’s
Conventional Team research

Focus on various areas, including human aspects.

Late 1990’s
Virtual Team research

Focus on technological and technical aspects mainly.

Literature Gap

Human aspects of virtual teamwork
(1) Cultural issues
(2) Self-efficacy
(3) Knowledge sharing

Theoretical Framework

(1) Hackman and Morris’s I-P-O model
(2) Individual cultural intelligence and openness
(3) Bandura’s social cognitive theory
(4) Nonaka’s SECI model
(5) Fishbein and Ajzen’s theory of reasoned action (TRA)

Research Outcome and Findings

Different findings between this research and existing literature

Discussion

Explain gaps by three arguments
(1) Impact of virtual working environment
(2) Influences of team member’s experiences during the virtual teamwork
(3) Effect of investigation in multiple culture setting

Contribution

(1) Theoretical contribution: new framework on virtual team study in cross-national environment.
(2) Practical contribution: application in selection, training, and employee development of virtual teams members.
7.5 New Model of Virtual Teamwork

The central purpose of this study is to construct a model of a virtual team that works in a cross-national environment. By applying the I-P-O model, this research focuses on the discussion of the inputs and processes as well as the relationship between these two stages, but not the output stage. Based on the research of Ang and Van Dyne (2008b), Fujimoto, Härtel and Härtel (2004), Bandura (1986), Fishbein and Ajzen (1975), and Nonaka (1994), this study developed the assumption that the effect of human factors can significantly affect virtual teamwork, and proposed research hypotheses for the investigation (see Chapter 2). However, the quantitative results shows that Hypotheses 1 to 3 can be partly supported while Hypothesis 5 cannot be supported. To explain why there are some gaps between the research findings and the literature review, this study utilised a qualitative approach and found that not only the human factors investigated but also other elements could be important in affecting virtual teamwork. Interpersonal trust, leadership, and technology support are three important moderator elements that affect the relationships between individual competencies and knowledge sharing within a virtual team. Moreover, the individuals’ experiences of team interaction and their language ability are two dominant elements that can directly influence individual competencies and knowledge sharing within a team.

As mentioned in previous sections, interviewees stressed that the virtual team interactions they experienced were mostly negative, and these experiences significantly affected their individual competencies and cooperation behaviour in completing the team task. Language ability is also emphasised by interviewees, because they stated that their English ability would significantly influence their self-confidence in communicating with team members in the virtual teamwork, and
their actions/reactions in team cooperation would be directly impacted by their language ability. In addition, this research found that the lack of interpersonal trust and leadership in virtual teams are most likely potential factors that affect the relationship between individual competencies and knowledge sharing; also, the role that technology plays should be emphasised to support successful virtual teamwork. All interview respondents stressed that technology is important for virtual team cooperation because their personal willingness, attitude, and behaviour to cooperate with team members in the virtual environment will be influenced by technical and technological factors as well.

Those potential influencing elements can explain why the relationships among variables proposed by the literature review are different from the quantitative findings of this virtual team research in reality. What has become clear is that four new relationships have been found in the inputs and processes stages of virtual teamwork: 1) individual competencies can be influenced by two dominant elements; 2) virtual team cooperation, namely knowledge sharing within a team, can be influenced by two dominant elements; 3) the positive effects of individual competencies on a virtual team’s knowledge sharing can be intervened by the impacts of three moderators; and 4) the positive effects of a member’s individual knowledge sharing willingness on their behaviour can be intervened by the impacts of three moderators. As the effects of individual competencies and the relationships that occur in the virtual teamwork can be significantly influenced by two dominant elements and three moderator factors, this research finally includes these five potential factors to develop the model of virtual team. Figure 7.2 demonstrates the all potential factors in a single model to explain how virtual teams work in the cross-national environment.
Figure 7.2: The model of virtual teamwork in the cross-national environment

**INPUT**
Individual Competencies
- Individual cultural intelligence
- Individual cultural openness
- Self-efficacy

**PROCESS**
Knowledge sharing
- Individual knowledge sharing willingness
- Knowledge sharing behaviour within a team

**OUTPUT**
Team performance
- Team member's satisfaction

**Dominant Elements**
- Experience of team interaction
- Language ability

**Moderator Element**
- Interpersonal trust
- Leadership
- Technology
7.6 Summary

The aim of this chapter was to discuss the findings of the research and construct the model of virtual teamwork in a cross-national environment. Three arguments were proposed to explain why there is the gap between research results and literature review: 1) the research investigated human factors in virtual settings which is different from existing studies of conventional face-to-face teams; 2) the investigation viewed the processes of virtual teamwork while previous studies only relied on a quantitative snapshot to examine; 3) the research addressed the influences of national differences on virtual teamwork through the use of cross-national investigation in developed and developing countries. This study is different from previous studies which only discussed virtual teamwork within a single country. As the nature of this research is quite different to existing studies, qualitative information can help to explore new findings, including that the human factors of a virtual team can be influenced by other potential elements. Two dominant elements, including experience of team interaction and language ability, were mentioned to discuss how and why they can directly impact on individual competencies and knowledge sharing. Three moderator elements, interpersonal trust, leadership, and technology support, can affect the relationship between the stages of inputs and processes. Finally, by understanding the potential factors, this research proposes a cross-national virtual teamwork model in the last section of this chapter.
Chapter 8: Conclusion

8.1 Introduction
The focus of this chapter is to emphasise the contributions of the study and provide suggestions for future research. Both the quantitative and qualitative results have been discussed and organised to create a model of virtual teamwork in a cross-national environment. The new findings of the virtual team model can make contributions to academia and industry. This chapter firstly provides a summary of the study which highlights the principle issues and findings. The chapter then concentrates on the theoretical contributions in response to the relevant literature and which fills the gap in academic research; this chapter also stresses the practical contributions that could have practical applications in business. Finally, the chapter recommends the trend for future research by discussing the limitations of this research and its implications.

8.2 Synthesis of the Study
The purpose of this research is to understand how virtual teams work in the cross-national environment. From the literature review, this study addresses the research gap by exploring key human factors that may have an influence on virtual team cooperation. In particular, the research tried to answer two central research questions, what are the main human factors affecting virtual teamwork in the cross-national environment, and, do those human factors have influential effects, why or why not? Through the literature review in Chapters 2 and 3, a research model containing human factors and potentially influencing factors was proposed for the investigation. Chapter 2 explained the gap in the literature between conventional and virtual teams and outlined that the effects of human factors have not been discussed
sufficiently about virtual teamwork. By applying the I-P-O model, the individual competencies of individual cultural intelligence, individual cultural openness, and self-efficacy, are considered as critical factors in the inputs stage, which influence the knowledge sharing process and the outcome of virtual teamwork. Positive relationships between all the observed human factors were identified and the research hypotheses for the investigation of a virtual team’s I-P-O model were developed in Chapter 2. However, other potential factors could have important influences on virtual team cooperation. Examining the role played by individual competencies in facilitating a virtual team’s knowledge sharing and a member’s satisfaction could not be satisfied in building a good understanding of virtual teamwork. Chapter 3 proposed other potential factors as moderators that could affect positive relationships between the human factors observed and virtual team cooperation. Communication, trust, and leadership are included in the discussion of virtual teamwork.

The research design and justification of the methodology are clearly described in Chapter 4, and an explanation of why the triangulation research method is applied in the study was provided. To understand the effect of the observed human factors, investigating the relationship between variables through a quantitative approach, quasi-experimental design with surveys, is one method of the study. However, in order to understand the reasons behind the influences of human factors and the effects of other potential factors, a qualitative approach, case study, provided comparable data and a comprehensive explanation for the research phenomenon, and it also avoided the same error in methods used previously.

Data analysis and findings were presented in Chapter 5 and 6. The quantitative data analysis in Chapter 5 showed that the results differed from the literature review which
indicated that the human factors investigated could not affect virtual team cooperation. By comparing the quantitative results for pre-test and post-test, the main effects of individual cultural intelligence and individual cultural openness on knowledge sharing willingness changed, mostly it had decreased. It can be assumed that the reasons for those changes are hidden in the process of virtual teamwork. Some potential factors could appear to influence teamwork significantly during the period of team interaction.

The quantitative results led to further discussion of why the influences of the investigated human factors on virtual teamwork are not significant. The qualitative analysis in Chapter 6 explained that the effects of those human factors are not key in affecting virtual team cooperation. The effects of those observed human factors could be moderated or intervened by other factors during the period of teamwork, hence, the importance of team interaction should be emphasised.

To stress the significance of this study, three arguments were proposed in Chapter 7 to discuss research findings that are different from existing research. This study is unique in that it researched a virtual working environment with cross-national locations and focused on analysing through viewing the process of virtual teamwork. This study was, therefore, able to find different results, such as other potential factors and new relationships within a team, providing a different view of a virtual team framework. Finally, by combining both quantitative and qualitative results with the in-depth discussion, this research constructed a model of virtual teamwork in the cross-national environment.

8.3 Contributions of the Study

8.3.1 Theoretical Contributions

This research provides a fundamental study for virtual teamwork model. The
proposed model is an original finding that gives an overview of virtual teamwork in a cross-national environment. Through the literature review, this study proposed a virtual team’s I-P-O (inputs-processes-outputs) model for research investigation. At the inputs stage, individual competencies were investigated, while, at the processes stage, two factors of a virtual team’s knowledge sharing were examined, and, at the output stage, a member’s satisfaction was tested. There are some gaps between the research results and the relevant literature because the human factors investigated above did not show that they had significant influences on virtual teamwork in this study. The evidence from the qualitative data assists this research by improving on the original I-P-O model to develop a virtual teamwork model by exploring other key influential factors on virtual team cooperation. The research findings of how virtual teams work in the context of cross-national boundaries also enhances the knowledge about the effects of human factors on teamwork which have rarely been discussed in previous research.

*To Study of Cultural Intelligence and Openness*

Ang and Van Dyne (2008a), and Fujimoto et al. (2004), have examined the effects of cultural intelligence and cultural openness on team cooperation respectively. Cultural intelligence is a significant factor that affects a multinational team’s collaboration and performance (Ang and Van Dyne, 2008a), while cultural openness can influence group processes and outcomes in a diverse workgroup (Fujimoto et al., 2004). Those studies were investigated in conventional face-to-face teams, so applying these two human factors in virtual teams can help to fill the gap in the academic literature. However, this research found that although individual cultural intelligence and openness have significant influences on conventional teamwork, they are not the main factors that affect virtual team cooperation because their effects can be seriously
impacted by other potential factors on virtual teamwork. For example, three moderators, interpersonal trust, leadership, and technology, have been explored as important factors that can influence the positive relationship between individual competencies and a virtual team’s knowledge sharing. Even though team members have good individual competencies for coping with diversity in the cross-national virtual team, they may not be willing to collaborate actively in teamwork if there is a lack of interpersonal trust, guidance from a leader, and supportive technology. As mentioned in Chapter 3, Henttonen & Blomqvist (2005) stressed the effect of trust on virtual team cooperation, whereas Pauleen (2003b) stated the importance of leadership in virtual teamwork. Nevertheless, their connections with individual competencies have rarely been discussed in the existing studies. This study provides a different view to explain the effect of individual cultural intelligence and individual cultural openness by developing an understanding of other intervening and moderating factors.

**To Study of Self-efficacy**

Self-efficacy is a core variable of Bandura’s social cognitive theory (1986) that has been commonly discussed in the workplace (Lent et al., 2006, Neck et al., 1999) but rarely investigated in a virtual team. Although Chiu et al. (2006), and Staples and Webster (2007), have discussed a virtual team’s knowledge transfer by applying the concept of self-efficacy, there is still the lack of investigation of the effects of self-efficacy on virtual teamwork. An important research finding in this study is that a team member’s self-efficacy could change during the period of virtual team activity. According to Bandura’s social cognitive theory (1986), human functioning is a triadic reciprocity model in which behaviour, cognitive, and environmental events can influence each other; thereby, it is not difficult to assume that self-efficacy can be
impacted by the external environment, such as outcome and experiences. The research results is consistent with social cognitive theory, which states that a virtual team member’s self-efficacy is highly related with their language ability and can be directly impacted by the team interaction experience during the period of the teamwork. For instance, some team members’ self-efficacy is remarkably reduced after participating in the virtual team activity because they found that communicating with other team members in English was not easy and they were frustrated with it. Their frustrating experiences in the teamwork affected their self-assessment. It is a significant result because interaction between self-efficacy and external environment could be firstly explored in the virtual teamwork setting. As this research observed the whole process of virtual teamwork, it found that self-efficacy, correlated with environmental events, occurred in the teamwork and the effect of self-efficacy can be influenced by other potential factors. This finding provides the better understanding of the role played by self-efficacy in facilitating a virtual team member’s cooperation that has not been well discussed in the relevant virtual team research.

To Study of Knowledge Sharing

This study discussed the virtual team’s knowledge sharing by utilising two concepts, knowledge sharing willingness and knowledge sharing behaviour. Fishbein and Ajzen’s Theory of Reasoned Action (TRA) (1975) and Nonaka’s SECI knowledge transferring model (1994) are applied respectively. Based on the research of Bock and Kim (2002), Fishbein and Ajzen (1975), and Samarah et al. (2008), the research proposed Hypothesis 5, that individual knowledge sharing willingness will positively influence knowledge sharing behaviour in teamwork; yet, this assumption was not supported by quantitative result.
According to Samarah et al. (2008), a virtual team member’s willingness to share knowledge is positively related to knowledge conversion, using Nonaka’s SECI model, because team members are more willing to, and actually do, share knowledge with each other, the knowledge conversion will be smoother and richer in virtual teams. This study found that real actions are more important than willingness to facilitate knowledge conversion because there is a gap between willing to do something and actually doing it, and the relationship between individual knowledge sharing willingness and actions for knowledge sharing behaviour in the virtual team could be seriously influenced by other potential factors. For example, the positive effects of individual knowledge sharing willingness on such behaviours can lessened by the lack of face-to-face communication in the teamwork. As the lack of face-to-face meetings can produce many problems and difficulties in communication between team members, it is possible that virtual team members who would otherwise be willing to share personal knowledge are not able to perform good and frequent knowledge sharing behaviour in the teamwork. The new finding that other moderating factors exist in the causal relationship between a virtual team’s knowledge sharing willingness and behaviour has rarely been explored in previous research. From the qualitative data, this study proposed potential moderators that can influence the effect of personal willingness on behaviour. It provides a different concept to existing studies that suggest a virtual team’s knowledge sharing is complicated since many potential influencing factors have been involved in the virtual working environment. Thus, utilising different methods to investigate virtual teamwork, such as the triangulation research method and analysis by viewing teamwork process, helped to fill the gap in the academic research about a virtual team’s knowledge sharing.
8.3.2 Practical Contributions

The results of this study could help companies manage and improve the cooperation and effectiveness of cross-national virtual teams by providing insights into how virtual teams work in cross-national environments. Recommendations for team member selection, team interaction control, and teamwork environment support are outlined below.

**Team Member Selection and Training**

From the quantitative and qualitative data, this research found that team members with more cross-cultural experiences, such as study abroad or work abroad experiences, will have higher individual competencies for dealing with diversity in virtual teamwork. Also, those cross-cultural experiences can positively influence their willingness to cooperate with others from different national backgrounds. It can be suggested that personal cross-cultural experiences should be considered as an important criteria in selecting virtual team members, especially for those teams working in the context of cross-national boundaries. Moreover, language ability is another significant criterion for virtual team member selection because it is usually a required skill for working with people from different countries. Even though the effect of individual competencies on virtual team cooperation can be affect by other moderators during the period of teamwork, it is still better to have high quality team members at the commencement of teamwork. As mentioned in the literature review, team cooperation and performance can be positively influenced by a member’s individual cultural intelligence (Ang and Van Dyne, 2008a), cultural openness (Fujimoto et al., 2004), and self-efficacy (Chiu et al., 2006); personal ability must be emphasised for team member recruitment. To ensue a member’s suitability to work and cooperate in an ongoing team, conducting an employee training and development
program, including the development of interpersonal communication skills in a virtual environment, and a language course, are also important strategies to improve a team member’s personal competencies. Making staff selections through the development of training programs can help virtual teams to work more efficiently and effectively because team members may have better competencies to overcome problems which may occur in the team.

**Team Interaction Control**

As found in this study, team interaction is the most important factor affecting virtual team cooperation because it can directly and immediately influence a team member’s individual attitude to share knowledge in a team. People will not be willing to collaborate with team members if they cannot get any feedback from others because of the uncomfortable feelings. In conventional face-to-face teamwork, members can easily understand each other by observing each other’s behaviours and getting immediate feedback and reactions from other team members, which enable them to be more willing to collaborate in the teamwork. By contrast, it is difficult to access team member’s trustworthiness in the virtual team environment due to the lack of physical contact (Powell et al., 2004), thus, building team trust to facilitate team interaction is a critical job for the virtual team management. As mentioned by Bierly et al. (2009)

> The role and importance of trust in virtual teams need to be revaluated; Managers using virtual teams need to realise that interpersonal relationship in virtual teams do not evolve in the same manner as face-to-face teams and may require different management techniques (Bierly et al., 2009, p.551).

This research suggests that developing institutional trust within a team instead of interpersonal trust between members can be a more efficient method to build team trust in virtual teams. Making clear team norms, rules, and providing guidance can be
useful strategies to help a virtual team operate more successfully. By obeying working rules and norms that define acceptable behaviour, team members can perform the positive behaviours that are required for completing team tasks, thereby activating effective team interaction.

In order to control team interaction, leadership behaviour is also emphasised because the leader has the official power to make rules to guide team members and organise teamwork to achieve the desired outcome by authorities. Owing to the high uncertainty of working in a virtual environment, team members may need direct guidance and advice to lead their cooperation behaviour. Both authoritarian and participative leadership styles could be useful in assisting virtual teamwork because they support decision-making within a team. By contrast, a laissez-faire leadership style is not suggested for managing virtual teams. For monitoring and controlling virtual teamwork, this study recommends that having a team leader and making team norms is necessary.

**Teamwork Environment Support**

Another important finding in this study shows that telecommunication infrastructure and technology must support the virtual teamwork; otherwise, a virtual team cannot work successfully. For example, the quality of internet connections is emphasised as an important factor that affects team member’s cooperation because their willingness to do virtual team task can be seriously influenced by the internet connection problems. However, it could have different conditions in the telecommunication infrastructure when a virtual team is working in the context of cross-national boundaries. Compared to developed countries, the telecommunication infrastructure in the developing countries cannot support virtual team operation very well.
Companies may need to increase their investment to improve telecommunication infrastructure in locations where technology is less developed. Moreover, this study also recommends that the use of multiple techniques, such as teleconferencing, online-phone, emails, and chat rooms, must be applied in order to support simultaneous communication between team members. Utilising those computer-based communication tools concurrently could significantly help to reduce the impacts of the lack of physical contact and improve the interaction between team members.

8.4 Limitations of the Study

The findings of this study can provide some contributions, but several limitations still exist in the research. This study was designed to explore how virtual teams work in the cross-national environment by investigating the effects of key human factors. One important objective of this study is to observe the whole process of virtual teamwork for the research analysis, thus, conducting quasi-experimental design to ensure the virtual team activity is essential for the study. In order to control the recruitment of experimental participants from different countries, the study decided to select university students as the research sample. However, a student workgroup cannot fully represent teamwork in business activities, although it is has been applied in previous research studies to simulate the work environment. Another issue that occurred in this research is the experimental participants’ attitudes toward virtual teamwork. All team members volunteered to participate in the virtual team. Participants could not get any benefit or lose by the result of the team’s performance so they did not take the virtual teamwork seriously. This situation meant that most virtual team cooperation was not successful, and this, in turn, could result in errors in the research; for example, some issues that influence successful teamwork may have not been identified and remain hidden. In terms of the research methodology, the
qualitative approach allowed this study to obtain a better understanding of virtual teamwork through the information obtained in the in-depth interviews. However, the sample size of 61 experimental participants could not be as large scale as the analysis using a quantitative approach, for instance, SEM analysis needs at least 100 cases as the sample size. There are some restrictions, such as time and finance, to conduct quasi-experimental design in this research, especially a cross-countries boundaries study, so it is hard to avoid that limitations could exist in the research.

8.5 Trend for Future Research

Based on the findings of this research, a range of areas for future study relating to the examination of a virtual team framework are suggested. First, the findings should encourage future virtual research to focus on the development and investigation of the model of a virtual team framework. There is still the shortage of current studies to explore virtual teams by observing the whole process of teamwork. This thesis provided an overview of how virtual teams work in a cross-national environment; however, the proposed model is the original finding of this study and has not been tested. It is recommended that future study should continue the investigation of this virtual teamwork model. Further research to discuss this model in different areas would help to modify the virtual teamwork model into a more complete one.

Second, future research into the effects of human factors on virtual team cooperation could pay more attention to the inter-relationship between human factors and team interaction experiences because they could be correlated with each other but may not have a simply causal relationship. The role played by team interaction, which can impact on human factors, especially on individual competencies, should be examined since this research has explored that the effects between human factors and team...
interaction is reciprocated with each other. As social cognitive theory (Bandura, 1986) stated, that self-efficacy can be influenced by external environment events, the same phenomenon could be seen in other personal abilities such as individual cultural intelligence and individual cultural openness. It is recommended that future studies could build the theoretical concept of virtual team interaction to investigate the proposed reciprocal relationship and to explore how this relationship could influence team member’s cooperation behaviour.

Third, the proposed three moderators in the study, interpersonal trust, leadership, and technology, can be regarded as either independent variables at the inputs stage or intervening variables between the inputs stage and the processes stage. The effect of these three moderators needs to be investigated and proved in the future, because this research just simply introduced their important influences after collecting data from interviewees. This research assumes that these three factors might be moderating effects between individual competencies and virtual team's knowledge sharing but it has not been clarified and tested. Investigating the relationship between these three moderators and virtual team cooperation could provide different views for the team management.

Fourth, exploring how virtual teams work in a cross-national environment setting is a new research field and this study mainly investigated virtual teamwork in the Asia Pacific region. In responding to globalisation, it is suggested that a global virtual team that includes countries from Europe, Africa, Latin America, and North America should be investigated in the future in order to build a fuller understanding of a multicultural virtual team. These studies would provide comprehensive knowledge to contribute to a global virtual team framework.
Finally, it is suggested that investigating live virtual teams in business enterprises can be considered for future study because the results can provide more useful practical application to business management. Selecting research samples from current employees who have virtual team experience, for either quantitative or qualitative data collection, can help research investigators to understand how virtual teams work for business purposes in the reality.
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Appendices

Appendix 1: Outline of experimental activity for participants

I. Experimental sample—Building virtual teams
1. Teammates are from different countries
   • E.g., Australia, Dubai, Indonesia, Malaysia, Thailand, Taiwan and Vietnam.
   • Every virtual team has five members those who have different nationalities.
2. Participants
   • University students who are studying Master of Business degree.

II. Virtual team’s task
1. Objective: Hiring a human resource manager.
2. Scenario:
   Students are HR managers in a global firm. The firm, now, is seeking all HR managers’ assistance to hire the most qualified candidate for the HR manager position in a new branch. (Please see details on next page).
3. Candidates for the HR manager position
   • 10 candidates’ CVs and detailed personal information will be given.
   • Selecting the most suitable HR manager from these 10 candidates.
4. Virtual setting
   • Working with other members by using computer based communication system (such as, email, discussion board, msn, online chat room, skype and so on).
5. Period for executing the project
   • About 4-5 weeks.
6. Team’s duty
   • Weekly report for the progress and problems (about one paragraph and informal).
   • Final report for selecting the HR manager (formal but in brief).

III. What are participants required to do in the experiment
1. Questionnaire survey
   • Pre-test at the beginning of the activity: about 55 items in total.
   • Post-test at the completion of the activity: about 74 items in total.
2. A formal online-meeting
   • At the beginning of the activity, participants have to introduce themselves to other teammates online during the particular time.
3. For ‘Plain Language Statement’, please refer to a page after.
Decision-making—Hiring Scenario

Students are employees in the department of human resource management in a global management-consulting firm.

Your Company Background—GLO Company (management-consulting firm)

GLO Company is a global management-consulting firm that has been growing rapidly, particularly in Asia and Oceania. The firm provides comprehensive business planning and analysis as well as consulting in operational and technical area, such as finance, marketing, and human resource management as well as information technology. Its client list includes small-sized firm and multinational corporations (MNCs).

The firm has offices in 10 countries (such as, Australia, Dubai, Singapore, Taiwan, and Thailand) with its world headquarters in Melbourne, Australia. You are a young, aggressive human resource manager in a company’s branch, which is located in your country. Now, the firm is planning to set a new branch and seeking all human resource managers’ assistance to hire the new human resource manager. Therefore, you and other HR managers must work together in virtual setting to recommend the most suitable person from several candidates.
INVITATION TO PARTICIPATE IN A RESEARCH PROJECT
PROJECT INFORMATION STATEMENT

Project Title:
- Virtual team's knowledge sharing and performance: the impact of cultural openness, cultural intelligence and self-efficacy

Investigators:
- Ms. Yu-Min Chou (PhD of management candidate)
- Dr. Greg Fisher (Senior Supervisor: B. Bus, MAA, PhD, Associate Professor, Business, Flinders University)
  - Phone: +61 8 8201 3118
  - Email: Greg.Fisher@flinders.edu.au

Nature of Research:
- PhD Requirement

Other Investigators:
- Dr. Alan Nankervis (BA (Hons), B.Soc/Admin., DBA (by research), Associate Professor, RMIT University)
- Dr. Ngan Collins (BA (Hons), MA, PhD, Lecturer, RMIT University)
Dear Sir / Madam,

If you are studying Master of Business degree, you are invited to participate in this 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.

**Who is involved in this research project? Why is it being conducted?**
Yu-Min Chou is conducting research investigating the relationships between self-efficacy, cultural openness, cultural intelligence, knowledge sharing, and performance in virtual teams. She is studying for her PhD of management at RMIT University, Melbourne, Australia and this research project is an important component of the course. The project is being conducted under the supervision of Dr. Greg Fisher, and has been approved by the RMIT Human Research Ethics Committee.

**What is the project about? What are the questions being addressed?**
This research examines the role played by self-efficacy, cultural openness and cultural intelligence in facilitating knowledge sharing in, and contributing to the performance of, virtual teams. The primary research question is what effects of individual’s cultural intelligence, cultural openness, and self-efficacy in facilitating virtual team’s knowledge sharing behaviour and performance are.

**Why have you been approached?**
The purpose of this research is to investigate the impact of individual attitude to cultural diversity on virtual knowledge sharing behaviour. Ensuring individual cultural difference is necessary, and assigning virtual team members from different national cultures is the simplest way to guarantee individual different in culture. Thus, this research plans to execute quasi-experiment by teams which comprise university students who are studying master of business degree, and will draw experimental samples from Master’s level students studying in different countries (e.g., Australia, Indonesia, Thailand, and Taiwan). As a result, the research investigators sought assistance from relevant course coordinator in order to find potential participants, and that is why you have been approached.

**If you agree to participate, you will participate in a virtual team exercise in which you will**
(1) Pre-activity (at the commencement of the virtual team exercise): complete an online survey questionnaire which asks you to respond individual demographic information, cultural openness, cultural intelligence, self-efficacy and knowledge sharing willingness. It takes about 40 minutes of your time.
(2) Participate in a virtual team online activity in which you will be asked to evaluate CVs against the job description, and recommend a select of applicants. It takes about 5 to 8 hours of your time.

(3) Post activity (at the completion of the virtual team exercise): complete an online survey questionnaire which asks you to respond individual demographic information, cultural openness, cultural intelligence, self-efficacy, knowledge sharing willingness and knowledge sharing behaviour as well as member satisfaction. It takes about 50 minutes of your time.

(4) You can see the details of this experimental activity in attached documents.

**What is the nature of the questionnaires? What are the risks or benefits associated with participation?**

The questionnaire is divided into seven sections as follows:

- Demographic information (age, gender, nationality, language, and studying & working experience)
- Cultural openness
- Self-efficacy
- Knowledge sharing behaviour
- Cultural intelligence
- Knowledge sharing willingness
- Member’s satisfaction

Most of the questions in two online-surveys are not personal (excluding demographic information) and none of questions is sensitive. However, you are welcome to examine all of the survey materials before making your decision as to whether you will participate. If you are unduly concerned about your responses to any of the questionnaires items or if you find participation in the project distressing, you are encouraged to make contact with relevant investigators to obtain assistance. We will discuss your concerns with you confidentially and suggest appropriate follow-up, if necessary.

Although your participation will not result in any immediate, direct benefit to you, it is a great opportunity to gain understanding of other different culture by working with people from different nationalities. This experience might help you to enhance your knowledge, and improve your cultural intelligence and communication skills.

**What will happen to the information you provide?**

To preserve your anonymity, we ask you NOT to place your name, or any identifying information anywhere on the survey. Your contact details have not been obtained, nor will they be, at any point. Thus, none of the information you provide can in any way be linked back to you. Upon submission, your responses will be entered electronically into a group database, from which only group data will be reported or published. This database is password protected and managed within the guidelines applicable to the secure storage of all electronic data within RMIT University. Only the primary and
supervising investigators will have access to this grouped data. In accordance with Human Research Ethics Committee guidelines, group data will be securely retained for a minimum of five years after publication, and then destroyed. Research data will be collated and analysed in a student report, and research findings may be disseminated in edited publications, through conference presentations. Only group data will be used for research purposes and in any future research publication. Individual responses will not be reported at any point. You are welcome to view the results of the research, which will be available in September 2011 (please contact the researchers directly for a summary of results). Because of the nature of the data collection, we are not able to obtain written informed consent from you. Instead, we assume that you have given consent by your voluntary access of this website, and your completion and submission of the survey.

**What are your rights as a participant?**
Please be advised that your participation in this study is completely voluntary. Should you wish to withdraw at any stage, or to withdraw any unprocessed data you have supplied, you are free to do so without prejudice. Your decision to participate or not, or to withdraw will be completely independent. If you would like to provide feedback about the survey, you can do so by emailing the researchers directly. If you have any complaints about your participation in this project, you can contact the Secretary, Portfolio Human Research Ethics Sub Committee, Business Portfolio, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is +61 3 9925 5594 or email address rdu@rmit.edu.au.

**Whom should you contact if you have any questions?**
Should you require any further information, or have any concerns (or questions), please do not hesitate to contact either of the researchers on the number given above.

**How do you agree to participate?**
If you would like to participate, please indicate that you have read and understand this information by filling the online consent form by clicking on “YES/NO” buttons, and indicate your willingness to consent by merely clicking “I agree” button then “Done” button at the end of the form on the http://www.surveymonkey.com/s/MKZWL9S The researchers will contact you.

**Yours sincerely**
Yu-Min Chou

Associate Professor     Greg Fisher

PhD of management candidate  B. Bus, MAA, PhD
**Appendix 2: Questionnaires**

**PRE-TEST**

**PART ONE: Demographic Information**

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How old are you?</td>
<td>☐ 20-24&lt;br&gt;☐ 25-30&lt;br&gt;☐ 31-35&lt;br&gt;☐ 36-40&lt;br&gt;☐ 41-45&lt;br&gt;☐ 46-50&lt;br&gt;☐ 51-55&lt;br&gt;☐ 56 or over</td>
</tr>
<tr>
<td>2. What is your gender?</td>
<td>☐ Female&lt;br&gt;☐ Male</td>
</tr>
<tr>
<td>3. What is your nationality?</td>
<td></td>
</tr>
<tr>
<td>4. What is your mother language?</td>
<td></td>
</tr>
<tr>
<td>5. Have you studied abroad?</td>
<td>☐ Yes, go to question 6&lt;br&gt;☐ No, go to question 7</td>
</tr>
<tr>
<td>6. How long have you studied abroad?</td>
<td>☐ 1. Less than 1 year&lt;br&gt;☐ 2. 1-3 years&lt;br&gt;☐ 3. 3-5 years&lt;br&gt;☐ 4. 5-10 years&lt;br&gt;☐ 5. 10 years +</td>
</tr>
<tr>
<td>7. Do you have any working experience?</td>
<td>☐ Yes, go to question 8&lt;br&gt;☐ No, go to Part Two</td>
</tr>
<tr>
<td>8. Have you worked abroad?</td>
<td>☐ Yes, go to question 9&lt;br&gt;☐ No, go to Part Two</td>
</tr>
<tr>
<td>9. How long have your worked abroad?</td>
<td>☐ 1. Less than 1 year&lt;br&gt;☐ 2. 1-3 years&lt;br&gt;☐ 3. 3-5 years&lt;br&gt;☐ 4. 5-10 years&lt;br&gt;☐ 5. 10 years +</td>
</tr>
</tbody>
</table>
**PART TWO: Cultural Intelligence**

Read each statement and select the response that best describes your capabilities. Select the answer that BEST describes you AS YOU REALLY ARE (1= strongly disagree; 7=strongly agree)

<table>
<thead>
<tr>
<th>CQ Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td>mc1</td>
<td>I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds.</td>
</tr>
<tr>
<td>mc2</td>
<td>I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.</td>
</tr>
<tr>
<td>mc3</td>
<td>I am conscious of the cultural knowledge I apply to cross-cultural interactions.</td>
</tr>
<tr>
<td>mc4</td>
<td>I check the accuracy of my cultural knowledge as I interact with people from different cultures.</td>
</tr>
<tr>
<td>cog1</td>
<td>I know the legal and economics systems of other cultures.</td>
</tr>
<tr>
<td>cog2</td>
<td>I know the rules (e.g., vocabulary, grammar) of other languages.</td>
</tr>
<tr>
<td>cog3</td>
<td>I know the cultural values and religious beliefs of other cultures.</td>
</tr>
<tr>
<td>cog4</td>
<td>I know the marriage systems of other cultures.</td>
</tr>
<tr>
<td>cog5</td>
<td>I know the arts and crafts of other cultures.</td>
</tr>
<tr>
<td>cog6</td>
<td>I know the rules for expressing nonverbal behaviours in other cultures.</td>
</tr>
<tr>
<td>mot1</td>
<td>I enjoy interacting with people from different cultures.</td>
</tr>
<tr>
<td>mot2</td>
<td>I am confident that I can socialize with locals in a culture that is unfamiliar to me.</td>
</tr>
<tr>
<td>mot3</td>
<td>I am sure I can deal with the stresses of adjusting to a culture that is new to me.</td>
</tr>
<tr>
<td>mot4</td>
<td>I enjoy living in cultures that are unfamiliar to me.</td>
</tr>
<tr>
<td>mot5</td>
<td>I am confident that I can get accustomed to the shopping conditions in a different culture.</td>
</tr>
</tbody>
</table>
| beh1      | Have you communicated with others who are from different cultural background face-to-face?  
  □ Yes (go to question 2)  
  □ No (go to question 3) |
| beh2      | I alter my facial expressions when a cross-cultural interaction requires it. |
| beh3      | I change my verbal behaviour (e.g., accent, tone) when a cross-cultural interaction requires it. |
| beh4      | I vary the rate of my speaking when a cross-cultural situation requires it. |
| beh5      | I use pause and silence differently to suit different cross-cultural situations. |
| beh6      | I change my nonverbal behaviour when a cross-cultural situation requires it. |
**PART THREE: Cultural Openness**

<table>
<thead>
<tr>
<th>CO Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thinking about when you are working in a team, please indicate the extent to which you agree with the following scenarios (1= strongly disagree; 7=strongly agree).</strong></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>I enjoy exchanging different ideas with team members who do tasks very differently from me.</td>
</tr>
<tr>
<td>CO2</td>
<td>I am excited to interact with team members whose behaviours are unfamiliar to me.</td>
</tr>
<tr>
<td>CO3</td>
<td>I feel excited to exchange different ideas with those whose working background is different from my own.</td>
</tr>
<tr>
<td>CO4</td>
<td>I feel enthusiastic to exchange opinions with those team members who are from a different country.</td>
</tr>
<tr>
<td>CO5</td>
<td>I enjoy being with people from other cultures.</td>
</tr>
</tbody>
</table>

**PART FOUR: Self-Efficacy**

<table>
<thead>
<tr>
<th>SE Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Select the answer that BEST describes you AS YOU REALLY ARE (1=strongly disagree; 7= strongly agree)</strong></td>
<td></td>
</tr>
<tr>
<td>SE1</td>
<td>I think I am a good member in my team.</td>
</tr>
<tr>
<td>SE2</td>
<td>I am sure I can do an excellent job on the problems and tasks.</td>
</tr>
<tr>
<td>SE3</td>
<td>I think my skills are excellent for doing the task.</td>
</tr>
<tr>
<td>SE4</td>
<td>I believe I have the ability to perform well in my teamwork</td>
</tr>
<tr>
<td>SE5</td>
<td>I suppose team performance will be good due to my contributions.</td>
</tr>
<tr>
<td>SE6</td>
<td>I know that I will be able to learn skills for this task.</td>
</tr>
</tbody>
</table>

**PART FIVE: Knowledge Sharing Willingness**

<table>
<thead>
<tr>
<th>KSW Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Select the answer that BEST describes you AS YOU REALLY ARE (1=strongly disagree; 7= strongly agree)</strong></td>
<td></td>
</tr>
<tr>
<td>AKSW1</td>
<td>Sharing my experience and ideas with other teammates is a (bad /... good) idea.</td>
</tr>
<tr>
<td>AKSW2</td>
<td>Sharing my knowledge with other teammates is a (foolish / wise) idea.</td>
</tr>
<tr>
<td>AKSW3</td>
<td>I (dislike/ ...like) to share my knowledge with other teammates.</td>
</tr>
<tr>
<td>AKSW4</td>
<td>Sharing my knowledge with other teammates would be (unpleasant/… very pleasant)</td>
</tr>
<tr>
<td>IKSW1</td>
<td>I will try to share my experience and knowledge with other teammates.</td>
</tr>
<tr>
<td>IKSW2</td>
<td>I will try to propose my ideas actively in team discussions.</td>
</tr>
<tr>
<td>IKSW3</td>
<td>I intend to help my teammates for solving their problems.</td>
</tr>
<tr>
<td>IKSW4</td>
<td>I intend to share knowledge with other teammates more frequently in the future.</td>
</tr>
</tbody>
</table>
## POST-TEST

### PART ONE: Demographic Information

1. How old are you?  
   - [ ] 20-24  
   - [ ] 25-30  
   - [ ] 31-35  
   - [ ] 36-40  
   - [ ] 41-45  
   - [ ] 46-50  
   - [ ] 51-55  
   - [ ] 56 or over

2. What is your gender?  
   - [ ] Female  
   - [ ] Male

3. What is your nationality?  
   _______________________________

4. What is your mother language?  
   _______________________________

5. Have you studied abroad?  
   - [ ] Yes, go to question 6  
   - [ ] No, go to question 7

6. How long have you studied abroad?  
   - [ ] 1. Less than 1 year  
   - [ ] 2. 1-3 years  
   - [ ] 3. 3-5 years  
   - [ ] 4. 5-10 years  
   - [ ] 5. 10 years +

7. Do you have any working experience?  
   - [ ] Yes, go to question 8  
   - [ ] No, go to Part Two

8. Have you worked abroad?  
   - [ ] Yes, go to question 9  
   - [ ] No, go to Part Two

9. How long have your worked abroad?  
   - [ ] 1. Less than 1 year  
   - [ ] 2. 1-3 years  
   - [ ] 3. 3-5 years  
   - [ ] 4. 5-10 years  
   - [ ] 5. 10 years +
## PART TWO: Cultural Intelligence

Read each statement and select the response that best describes your capabilities. Select the answer that BEST describes you AS YOU REALLY ARE (1= strongly disagree; 7=strongly agree)

<table>
<thead>
<tr>
<th>CQ Factor</th>
<th>Questionnaire items</th>
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</thead>
<tbody>
<tr>
<td>mc1</td>
<td>I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds.</td>
</tr>
<tr>
<td>mc3</td>
<td>I am conscious of the cultural knowledge I apply to cross-cultural interactions.</td>
</tr>
<tr>
<td>mc4</td>
<td>I check the accuracy of my cultural knowledge as I interact with people from different cultures.</td>
</tr>
<tr>
<td>cog1</td>
<td>I know the legal and economics systems of other cultures.</td>
</tr>
<tr>
<td>cog2</td>
<td>I know the rules (e.g., vocabulary, grammar) of other languages.</td>
</tr>
<tr>
<td>cog3</td>
<td>I know the cultural values and religious beliefs of other cultures.</td>
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<tr>
<td>cog4</td>
<td>I know the marriage systems of other cultures.</td>
</tr>
<tr>
<td>cog5</td>
<td>I know the arts and crafts of other cultures.</td>
</tr>
<tr>
<td>cog6</td>
<td>I know the rules for expressing nonverbal behaviours in other cultures.</td>
</tr>
<tr>
<td>mot1</td>
<td>I enjoy interacting with people from different cultures.</td>
</tr>
<tr>
<td>mot2</td>
<td>I am confident that I can socialize with locals in a culture that is unfamiliar to me.</td>
</tr>
<tr>
<td>mot3</td>
<td>I am sure I can deal with the stresses of adjusting to a culture that is new to me.</td>
</tr>
<tr>
<td>mot5</td>
<td>I am confident that I can get accustomed to the shopping conditions in a different culture.</td>
</tr>
<tr>
<td>beh1</td>
<td>Have you communicated with other teammates by using telephone or online-phone?</td>
</tr>
<tr>
<td></td>
<td>□ Yes (go to question 2)</td>
</tr>
<tr>
<td></td>
<td>□ No (go to question 4)</td>
</tr>
<tr>
<td>beh2</td>
<td>I change my verbal behaviour (e.g., accent, tone) when I communicate with other teammates who are from different cultural background.</td>
</tr>
<tr>
<td>beh3</td>
<td>I vary the rate of my speaking when I communicate with other teammates who are from different cultural background.</td>
</tr>
<tr>
<td>beh4</td>
<td>I check spelling and punctuation when I post my writing on the discussion board (or email to others) for making easily understanding.</td>
</tr>
<tr>
<td>beh6</td>
<td>I use simple sentences and words on my writing when I post my writing on the discussion board (or email to others) for making easily understanding.</td>
</tr>
</tbody>
</table>

Note: question items, CQmc2, CQmot4 and CQbeh5, have been eliminated in the post-test questionnaire due to the lack of item discrimination in the pre-test examination.
**PART THREE: Cultural Openness**

<table>
<thead>
<tr>
<th>CO Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking about when you are working in a team, please indicate the extent to which you agree with the following scenarios (1= strongly disagree; 7=strongly agree).</td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>I enjoy exchanging different ideas with team members who do tasks very differently from me.</td>
</tr>
<tr>
<td>CO2</td>
<td>I am excited to interact with team members whose behaviours are unfamiliar to me.</td>
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<tr>
<td>CO3</td>
<td>I feel excited to exchange different ideas with those whose working background is different from my own.</td>
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<tr>
<td>CO4</td>
<td>I feel enthusiastic to exchange opinions with those team members who are from a different country.</td>
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<tr>
<td>CO5</td>
<td>I enjoy being with people from other cultures.</td>
</tr>
</tbody>
</table>

**PART FOUR: Self-Efficacy**

<table>
<thead>
<tr>
<th>SE Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select the answer that BEST describes you AS YOU REALLY ARE (1=strongly disagree; 7= strongly agree)</td>
<td></td>
</tr>
<tr>
<td>SE1</td>
<td>I think I am a good member in my team.</td>
</tr>
<tr>
<td>SE2</td>
<td>I am sure I can do an excellent job on the problems and tasks.</td>
</tr>
<tr>
<td>SE3</td>
<td>I think my skills are excellent for doing the task.</td>
</tr>
<tr>
<td>SE4</td>
<td>I believe I have the ability to perform well in my teamwork.</td>
</tr>
<tr>
<td>SE5</td>
<td>I suppose team performance will be good due to my contributions.</td>
</tr>
<tr>
<td>SE6</td>
<td>I know that I will be able to learn skills for this task.</td>
</tr>
</tbody>
</table>

**PART FIVE: Knowledge sharing willingness**

<table>
<thead>
<tr>
<th>KSW Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select the answer that BEST describes you AS YOU REALLY ARE (1=strongly disagree; 7= strongly agree)</td>
<td></td>
</tr>
<tr>
<td>AKSW1</td>
<td>Sharing my experience and ideas with other teammates is a (bad/…good) idea.</td>
</tr>
<tr>
<td>AKSW2</td>
<td>Sharing my knowledge with other teammates is a (foolish / wise) idea.</td>
</tr>
<tr>
<td>AKSW3</td>
<td>I (dislike/ …like) to share my knowledge with other teammates.</td>
</tr>
<tr>
<td>AKSW4</td>
<td>Sharing my knowledge with other teammates would be (unpleasant/… very pleasant)</td>
</tr>
<tr>
<td>IKSW1</td>
<td>I will try to share my experience and knowledge with other teammates.</td>
</tr>
<tr>
<td>IKSW2</td>
<td>I will try to propose my ideas actively in team discussions.</td>
</tr>
<tr>
<td>IKSW3</td>
<td>I intend to help my teammates for solving their problems.</td>
</tr>
<tr>
<td>IKSW4</td>
<td>I intend to share knowledge with other teammates more frequently in the future.</td>
</tr>
</tbody>
</table>
## PART SIX: Knowledge sharing behaviour

<table>
<thead>
<tr>
<th>KSB Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select the answer that BEST describes you AS YOU REALLY ARE (1=strongly disagree; 7= strongly agree)</td>
</tr>
<tr>
<td>EKSB1</td>
<td>In my team, knowledge like know-how, technical skill, or problem solving methods is well codified.</td>
</tr>
<tr>
<td>EKSB2</td>
<td>In my team, knowledge can be acquired through formal document and manuals.</td>
</tr>
<tr>
<td>EKSB3</td>
<td>In my team, the results are always been documented after discussing.</td>
</tr>
<tr>
<td>EKSB4</td>
<td>In my team, knowledge is shared in codified forms like manuals or documents.</td>
</tr>
<tr>
<td>EKSB5</td>
<td>In my team, we usually share ideas and images with others by using charts and pictures.</td>
</tr>
<tr>
<td>EKSB6</td>
<td>In my team, we usually propose new ideas through formal discussion.</td>
</tr>
<tr>
<td>IKSB1</td>
<td>I can take successful examples from inside the team and sharing them for using.</td>
</tr>
<tr>
<td>IKSB2</td>
<td>I can exercise the knowledge gained through training, manuals, and documents, and assess its effectiveness.</td>
</tr>
<tr>
<td>IKSB3</td>
<td>I can obtain knowledge (such as, know-how, technical skill, and problem solving methods) through formal documents which shared by my teammates.</td>
</tr>
<tr>
<td>IKSB4</td>
<td>I can enhance my knowledge by formal discussions with my teammates.</td>
</tr>
</tbody>
</table>

## PART SEVEN: Member’s satisfaction

<table>
<thead>
<tr>
<th>MS Factor</th>
<th>Questionnaire items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select the answer that BEST describes you AS YOU REALLY ARE (1=strongly disagree; 7= strongly agree)</td>
</tr>
<tr>
<td>MSO1</td>
<td>I think the quality of decision making in my team was perfect.</td>
</tr>
<tr>
<td>MSO2</td>
<td>I think my team was working successfully.</td>
</tr>
<tr>
<td>MSO3</td>
<td>I am satisfied with my team performance generally.</td>
</tr>
<tr>
<td>MSO4</td>
<td>I believe my team has achieved the expected outcomes.</td>
</tr>
<tr>
<td>MSP1</td>
<td>I am satisfied with the collaboration process between team members.</td>
</tr>
<tr>
<td>MSP2</td>
<td>I think other team members are good teammates for sharing their knowledge.</td>
</tr>
<tr>
<td>MSP3</td>
<td>I believe I have obtained knowledge by working with other teammates.</td>
</tr>
<tr>
<td>MSP4</td>
<td>I believe my teammates enjoy working with one another during our teamwork.</td>
</tr>
<tr>
<td>MSP5</td>
<td>I am willing to work with my teammates again if there is another opportunity.</td>
</tr>
</tbody>
</table>
Appendix 3: Interview guide and questions

Interview Guide

Date of interview:

Institution Profile

Name of the university:
The year of establishment:
Campus location:
Total number of students in 2011:
(approximately)
Number of international students in 2011:
(approximately)
Percentage of international students in 2011: %
Main countries of origin:
(1)
(2)
(3)
Major areas of study:
(1)
(2)
(3)
Program name:

Many thanks for your participation in this interview. Firstly, I would like to know your background.

Interviewee background

Age of interviewee:
Are you a part-time student? or full-time student?
Have you participated in the virtual team project conducted by this research?
   If yes, which team you belong to?
      (Please go to Part A to continue the interview questions)

   If no, (please go to Part B to continue the interview questions).
Part A: interview questions for virtual team participants

Thanks for your background information; now, I am going to ask you about your previous experience in cross-cultural environment and teamwork.

**Cross-cultural experience**

<table>
<thead>
<tr>
<th></th>
<th>Yes or No</th>
<th>How many times?</th>
<th>How long?</th>
<th>Which countries?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have travelled overseas?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have studied overseas?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have worked overseas?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have worked in an international firm?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have friends who are from other counties?</td>
<td>How many friends?</td>
<td></td>
<td>Which countries?</td>
<td></td>
</tr>
</tbody>
</table>

How do the above experience influence

1. your understanding of other cultures
2. your willingness to contact other cultures
3. your self-confidence to work with people from other cultures
4. your attitude to sharing knowledge with foreigners

**Traditional team experience**

How many times did you participate in teams (e.g., assignment group) in the past 12 months?
What were the main reason of your participate in these teams?
Could you please tell me any positive experience of these participations?
Could you please tell me any negative experience of these participations?
Do these experiences influence your willingness to participate in other teams in the future?
If yes, why?
If no, why not?
Virtual team experience and its influence
You have participated in the virtual team conducted by this research.
Could you please tell me one positive experience of this virtual teamwork?
Could you please tell me one negative experience of this virtual teamwork?
In your opinion, are the experiences that you got from this virtual teamwork mostly positive or negative?
   If mostly positive, please answer questions of Section A
   If mostly negative, please answer questions of Section B

Section A: the influence of positive experience
Do these positive experiences influence your willingness to participate in other virtual teams in the future?
   If yes, why?
   If no, why not?
How do these positive experience influence
   (1) your understanding of other cultures
   (2) your willingness to contact other cultures
   (3) your self-confidence to work with people from other cultures
   (4) your attitude to sharing knowledge with foreigners
Based on the positive experience that you got from the virtual team activity,
   (1) how do you think about sharing your knowledge in a virtual team?
      Good idea? Why?
      Bad idea? Why?
   (2) how do you think about contacting unfamiliar cultures in a virtual team?
      Positive feeling? Why?
      Negative feeling? Why?
   (3) how do you think your confidence has been changed?
      Increased? Why?
      Decreased? Why?

Section B: the influence of negative experience
Do these negative experiences influence your willingness to participate in other virtual teams in the future?
   If yes, why?
   If no, why not?
How do these negative experience influence
   (1) your understanding of other cultures
   (2) your willingness to contact other cultures
Based on the negative experience that you got from the virtual team activity,
(1) how do you think about sharing your knowledge in a virtual team?
   - Good idea? Why?
   - Bad idea? Why?
(2) how do you think about contacting unfamiliar cultures in a virtual team?
   - Positive feeling? Why?
   - Negative feeling? Why?
(3) how do you think your confidence has been changed?
   - Increased? Why?
   - Decreased? Why?

**Potential factors influence on the virtual team interaction**

Many thanks for sharing your personal experience that you got from this virtual team activity. Now, I would like to know more details about your virtual team interaction and find other important factors that may influence virtual team’s knowledge sharing and performance. Therefore, I am going to ask you the following questions.

**Technology & Technique**

Did you have any trouble for the internet connection during the period of virtual teamwork?
   - If yes,
     (1) what was it?
     (2) how did this problem impact on your willingness and behaviour to share knowledge with teammates?
   - If no,
     Would internet connection problems impact on your willingness and behaviour to do the virtual teamwork if you would have had this trouble?

Did you have any trouble for using RMIT Blackboard during the period of virtual teamwork?
   - If yes,
     (1) what was it?
     (2) how did this problem impact on your willingness and behaviour to share knowledge with teammates?
   - If no,
     Would user-interface design (for example, user-friendly or not) impact on
your willingness and behaviour to do the virtual teamwork?
  If yes, why?
  If no, why not?
After this virtual team activity, do you agree the advance of technology can resolve different time zone problem?
  If yes, why?
  If no, why not?

**Communication style**

In general, what kind of communication style do you prefer if you work in a traditional team?
  (1) face-to-face communication? Why?
  (2) computer-based communication(such as, emails, SMS and so on)? Why?
What do you think communicating with teammates only by telecommunication in the virtual team?
  Convenient for team interaction? Why?
  Difficult for team interaction? Why?
How frequently did you communicate with your teammates by using computer-based technology during the period of virtual teamwork?
  Very often / Often / Sometimes/ Few times/ Not at all
  Why?
Did the lack of face-to-face communication affect your willingness and behaviour to share personal knowledge within a team?
  If yes, why?
  If no, why not?

**Leadership**

In general, what kind of team do you prefer?
  (1) there is a team leader? Why?
  (2) there is no team leader? Why?
Would you more actively communicate with your teammates (such as, post you opinions online) if there was a leader in your virtual team?
  If yes, why?
  If no, why not?
Would you more actively share your knowledge within a team if your virtual team teamwork was well-controlled by a team leader?
  If yes, why?
  If no, why not?
In your opinion, does having a team leader influence virtual team interaction and performance?
   If yes, why?
   If no, why not?

**Team interaction**
Did you have any trouble to interact with your teammates during the period of virtual teamwork? (such as, no response from your teammates, late reply and so on.)
   If yes,
      (1) what was it ?
      (2) how did this problem impact on your willingness and behaviour to share knowledge with teammates?
   If no,
   Would the interaction with your teammates affect your willingness and behaviour to do the virtual teamwork?
      If yes, why?
      If no, why not?
Would you more actively share your knowledge within a team if your teammates more actively participated in the virtual team?
   If yes, why?
   If no, why not?

**Interpersonal trust**
What is your opinion about interpersonal trust?
In general, would you share your personal knowledge with someone you trust and have confidence in him (her)?
   If yes, why?
   If no, why not?
What did you think about sharing your knowledge with teammate those who you have never met when you worked in the virtual team?
How did this attitude affect your willingness and behaviour to share your knowledge when you worked in the virtual team?

**Language**
How much confidence do you have in your English ability?
   Listening?     Speaking?     Reading?     Writing?
How do you think about using English to communicate with English native speakers?
How do you think about using English to communicate with people who are not English native speakers?
Did your English ability affect your willingness to work with your teammates when you worked in the virtual team?
   If yes, why?
   If no, why not?

Other factors
Based on your experience in the virtual teamwork,
In your opinion, what were the other factors might influence your virtual team interaction and team performance?
   (1) what were other factors?
   (2) why?

Individual cultural intelligence, individual cultural openness, and self-efficacy
Thanks for sharing your valuable opinions. Now, I am going to ask you something about your personal attitude toward different cultures, such as your individual cultural intelligence, cultural openness, and self-efficacy.

Individual cultural intelligence
Before asking questions, I would like to explain the meanings of individual cultural intelligence firstly.

*Individual cultural intelligence:*
*Your personal ability (such as, knowledge and skills) to help you interact effectively with others from different cultural backgrounds.*

Could you please share your knowledge about one culture that is different from your own?
How much confidence do you have in your knowledge about other cultures?
   Very confident / Confident / Neutral/ Few confident / Not at all
   Why do you think so?
In the virtual team, are you more willing to work with people who have higher cultural intelligence?
   If yes, why?
   If no, why not?
Do you think your knowledge about other cultures influenced your activities when you worked in the virtual team?
If yes, why?
If no, why not?

**Individual cultural openness**
Before asking following questions, I would like to explain the meanings of individual cultural openness.

*Individual cultural openness:*
Your personal willingness and attitude to interact with people from other cultures that is unfamiliar with you.

In general, are you willing to contact people whose cultural background is unfamiliar with you?
If yes, why?
If no, why not?

What do you prefer if you would have a choice for selecting your co-workers?
(1) Working with foreigners? Why?
(2) Working with locals? Why?

How did this attitude affect your willingness for participating in the virtual team activity?
Do you think your attitude toward unfamiliar cultures influenced your cooperation with other teammates in the virtual team activity?
If yes, why?
If no, why not?

**Self-efficacy**
Before asking following questions, I would like to explain the meanings of self-efficacy.

*Self-efficacy:*
Your self-confidence about your ability to produce good performance when you working with others from different cultural backgrounds.

How much confidence do you have in your personal ability to work with foreigners?
Very confident / Confident / Neutral/ Few confident / Not at all
Why do you think so?

How did your self-confidence affect your willingness to participate in this virtual team activity?
Do you think that your team member’s self-confidence influenced their cooperation with other teammates in the virtual team activity?

--The end of interview questions, thank you for help--
Part B: interview questions for non-virtual team participants

Thanks for the information of your background; now, I am going to ask you about your experience in cross-cultural environment and teamwork.

**Cross-cultural experience**

<table>
<thead>
<tr>
<th></th>
<th>Yes or No</th>
<th>How many times?</th>
<th>How long?</th>
<th>Which countries?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have travelled overseas?</td>
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<tr>
<td>Have studied overseas?</td>
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<tr>
<td>Have worked overseas?</td>
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<tr>
<td>Have worked in an international firm?</td>
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<tr>
<td>Have friends who are from other counties?</td>
<td>How many friends?</td>
<td>Which countries?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How do the above experience influence

1. your understanding of other cultures
2. your willingness to contact other cultures
3. your self-confidence to work with people from other cultures
4. your attitude to sharing knowledge with foreigners

**Traditional (virtual) team experience & its influence**

How many times did you participate in teams (e.g., assignment group) in the past 12 months?

What are the main reason of your participate in these teams?

Have you participated in any virtual team activities in the past?

If yes,

1. Could you please tell me any positive experience of these participations?
2. Could you please tell me any negative experience of these participations?

If no,

1. Could you please tell me any positive experience of the past traditional teamwork?
(2) Could you please tell me any negative experience of the past traditional teamwork?

Do the above experiences influence your willingness to participate in other teams (or, virtual team) in the future?
   If yes, why?
   If no, why not?

**Individual knowledge sharing willingness and behaviour**

After discussing your previous experience, I would like to know your attitude about sharing personal knowledge with foreigners.

**Willingness to sharing knowledge with foreigners**

How do you think about having an opportunity to work with people from other countries?

If you would have an opportunity to select your co-workers, what do you prefer?
   (1) Working with foreigners? Why?
   (2) Working with locals? Why?

**Willingness and behaviour to share knowledge in virtual team**

How do you think about having an opportunity to work with foreigners in a virtual team?

If you would have an opportunity to work with foreigners in a virtual team,
   (1) are you willing to share your personal knowledge with them?
      If yes, why?
      If no, why not?
   (2) how frequently would you like to communicate with them by using computer-based technology during a week?
      Every days (7 times) / 5-6 times / 3-4 times/ 1time-2 times / wouldn’t contact
      Why?

**Individual cultural intelligence, individual cultural openness, and self-efficacy**

Thanks for sharing your valuable opinions. Now, I am going to ask you something about your personal attitude toward different cultures, such as your individual cultural intelligence, cultural openness, and self-efficacy.

**Individual cultural intelligence**

Before asking questions, I would like to explain the meanings of individual cultural
intelligence firstly.

**Individual cultural intelligence:**

*Your personal ability (such as, knowledge and skills) to help you interact effectively with others from different cultural backgrounds.*

Could you please share your knowledge about one culture that is different from your own?

How much confidence do you have in your knowledge about other cultures?

- Very confident
- Confident
- Neutral
- Few confident
- Not at all

Why do you think so?

Are you more willing to work with foreigners if you would have a better understanding about their cultures?

- If yes, why?
- If no, why not?

If you would have an opportunity to work with foreigners in a virtual team,

1. are you more willing to work with people who have higher cultural intelligence?
   - If yes, why?
   - If no, why not?

2. does your knowledge about other cultures influence your interaction with teammates in a virtual team?
   - If yes, why?
   - If no, why not?

**Individual cultural openness**

Before asking following questions, I would like to explain the meanings of individual cultural openness.

**Individual cultural openness:**

*Your personal willingness and attitude to interact with people from other cultures that is unfamiliar with you.*

In general, are you willing to contact people whose cultural background is unfamiliar with you?

- If yes, why?
- If no, why not?

If you would have an opportunity to work with foreigners in a virtual team,

1. does your attitude toward unfamiliar cultures influence your cooperation with other teammates?
   - If yes, why?
   - If no, why not?
**Self-efficacy**
Before asking following questions, I would like to explain the meanings of self-efficacy.

**Self-efficacy:**
*Your self-confidence about your ability to produce good performance when you working with others from different cultural backgrounds.*

How much confidence do you have in your personal ability to work with foreigners?

Very confident / Confident / Neutral/ Few confident / Not at all

Why do you think so?

If you would have an opportunity to work with foreigners in a virtual team,

1. do you actively communicate and cooperate with them?
   - If yes, why?
   - If no, why not?

2. how does your self-confidence influence your cooperation with other teammates?

**Potential factors influence on knowledge sharing in virtual setting**
Many thanks for sharing your personal knowledge and experience. Let’s move on the last section. I would like to find what other important factors may influence virtual team’s knowledge sharing and performance. Therefore, I am going to ask you the following questions.

**Language**

How much confidence do you have in your English ability?

Listening? Speaking? Reading? Writing?

How do you think about using English to communicate with English native speakers?

How do you think about using English to communicate with people who are not English native speakers?

If you would have an opportunity to work with foreigners in a virtual team,

1. does your English ability impact on your willingness to work with foreigners within a team?
   - If yes, why?
   - If no, why not?

**Technology & Technique**

If you would have an opportunity to work with foreigners in a virtual team,
(1) how does internet connection condition (e.g., the access of internet or the quality of wireless) impact on your willingness to do virtual team work?
(2) how does user-interface (e.g., user-friendly or not) design impact on your willingness to do virtual team work?
(3) do you agree that different time zone problem can be resolved by the advance of technology?
  If yes, why?
  If no, why not?

**Interpersonal trust**
What is your opinion about interpersonal trust?
In general, would you share your personal knowledge with someone you trust and have confidence in him (her)?
  If yes, why?
  If no, why not?
If you would have an opportunity to work with foreigners in a virtual team,
  (1) what do you think about sharing your knowledge with people you have never met?
  (2) how does this attitude affect your willingness and behaviour to share your knowledge within a team?

**Communication style**
In general, what kind of communication style do you prefer if you work in a team?
  (1) face-to-face communication? Why?
  (2) computer-based communication (such as, emails and web messengers)? Why?
If you would have an opportunity to work with foreigners in a virtual team,
  (1) what do you think communicating with teammates only by telecommunication?
    Convenient for team interaction? Why?
    Difficult for team interaction? Why?
  (2) does the lack of face-to-face communication affect your willingness and behaviour to share personal knowledge within a team?
    If yes, why?
    If no, why not?

**Leadership**
If you would have an opportunity to choose a team that you work with, what do
you prefer?
(1) there is a team leader? Why?
(2) there is no team leader? Why?
If you would have an opportunity to work with foreigners in a virtual team,
(1) what kind of virtual team do you prefer?
   Has a team leader? Why?
   Has no team leader? Why?
(2) are you more willing to share your knowledge within a team if your virtual team teamwork is well-controlled by a team leader?
   If yes, why?
   If no, why not?
(3) in your opinion, would virtual team interaction and performance be influenced by a team leader?
   If yes, why?
   If no, why not?

**Other factors**
In your opinion, what are the other factors might influence virtual team interaction and team performance?
(1) what are other factors?
(2) why?

--The end of interview questions, thank you for help--