THE INTERACTIVE EFFECT OF COMMUNICATION MEDIA CHOICE AND PERSONAL RELATIONSHIPS ON TACIT KNOWLEDGE TRANSFER SUCCESS

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ABSTRACT

The transfer of tacit knowledge can be facilitated by personal relationship strength and by choosing appropriate communication media. However, the interactive effect of personal relationships and media choice on tacit knowledge transfer success has not been studied. Therefore, this study aims to investigate how relationship strength and media choice affect tacit knowledge transfer, and most importantly, how media choice interacts with relationship strength.

Data were collected via a questionnaire survey of New Zealand university teachers in the disciplines of human health and medicine. Exploratory Factor Analysis and Structural Equation Modelling were used to analyse the survey data and to test the model. Then, follow-up interviews were carried out with six participants, to collect in-depth qualitative data focusing on the mechanisms behind the relationships to be found statistically significant in the model.

Fitting the model by using partial least square structural equation modelling suggested that a higher level of closeness between individuals lead to better tacit knowledge transfer success, the relationship was stronger when individuals use both synchronous media and asynchronous media than when they use only synchronous media. Qualitative results were used to help interpret the quantitative findings by highlighting the importance of the development of common understanding, and by pointing out the fact that individuals adjusted their communication styles to be more suitable for each other.

This study contributes to theory by testing Media Synchronicity Theory in the field of tacit knowledge transfer, and by exploring the mechanisms of the change of individuals' media choice over time.

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LIST OF ABBREVIATIONS

AVE	:	Average variance extracted
CMV	:	Common method variance
EFA	:	Exploratory factor analysis
EM method	:	Expectation-maximisation method
ICT	:	Information and communication technology
MRT	:	Media richness theory
MST	:	Media synchronicity theory
PLS	:	Partial least squares
SECI	:	Nonaka and Takeuchi's (1995) of knowledge creation model which consists of four modes: socialisation, externalisation, combination, and internalisation
SEM	:	Structural equation modelling
TIP	:	Time, interaction, and performance theory

CHAPTER 1. INTRODUCTION

1.1 Background of the study

Knowledge is an important resource for modern organisations as organizations successful at generating, transferring, and adopting knowledge are likely to gain competitive advantage. It is common to distinguish explicit knowledge and tacit knowledge. Explicit knowledge can be easily captured, transferred, and organised in digital form, while tacit knowledge is highly personal and context specific and cannot be easily formalised (Pearlson & Saunders, 2006). Tacit knowledge is widely believed to be a source of sustained competitive advantage, because it is difficult to transfer between different organisational contexts (Cavusgil, Calantone, & Zhao, 2003; Johannessen, Olaisen, & Olsen, 2001; SENKER, 1995). Direct interactions between individuals is necessary for transfer of tacit knowledge (Nonaka & Takeuchi, 1995). Therefore, communication between employees is one of the most important ways for creating and transferring tacit knowledge in a modern organisation.

Close personal relationships between individuals could significantly influence the success of tacit knowledge transfer (Hansen, 1999; Joia & Lemos, 2010; Walther, 1992), because they allow the establishment of common understanding (Carlson & Zmud, 1999). Close personal relationships also means individuals to spend less cognitive effort on interpreting received messages (Kock, 2004), and are able to have frequent and in-depth interaction (Nonaka & Konno, 1998).

In modern work environments, technologies enabling a broad range communication patterns are available (Daft & Lengel, 1986; Dennis, Fuller, & Valacich, 2008). Media Synchronicity Theory (MST) (Dennis et al., 2008) distinguishes the extent to which the communication media enables the exchange of timely and rich in content messages, as well as communications between individuals who are more or less familiar with each other and with the media they are using. Communication media and their patterns of use have been shown to affect tacit knowledge transfer success. For example, synchronous communication involving rich content and immediate

feedback tends to support the transfer of tacit knowledge better than asynchronous communication (Joia & Lemos, 2010; Murray & Peyrefitte, 2007).

1.2 Problem statement

While both media choice and the personal relationship between individuals have been demonstrated to affect knowledge transfer success in separate studies, media choice and personal relationships have never been considered in a single model. Therefore, interaction effects between these two constructs have never been explored. In particular, depending on the media choice, the personal relationship between individuals may affect the knowledge transfer success differently. Therefore, the purpose of my study is to fill the research gap by exploring the interaction between the effects of media choice and personal relationship on tacit knowledge transfer success.

1.3 Research questions

Based on the problem stated above, the research question for this study is stated as follows:

> *Is the effect of the relationship strength between individuals on the success of tacit knowledge transfer stronger when people use asynchronous media than when people use synchronous media? What are the underlying mechanisms?*

In other words, the research is concerned with whether the same media and pattern of communication would work well to support tacit knowledge transfer between individuals who know each other and have a close relationship and to support tacit knowledge transfer between individuals who are strangers.

It is expected that media that enables the exchange of timely and rich in content messages supports tacit knowledge exchange both between individuals who know each other and between strangers. Conversely, media that is poor in such capabilities disadvantages individuals who are not familiar with each other.

To address the research question stated above, a structural model was formulated, which involved the effect of personal relationship on tacit knowledge transfer success and the moderation effect of communication media choice.

This study drew from two theoretical perspectives: theories of tacit knowledge transfer and Media Synchronicity Theory. Although knowledge transfer can be studied on both organisational and individual levels this study focuses on tacit knowledge transfer activities on an individual level.

1.4 Scope of the study

This study followed studies in the field of tacit knowledge transfer (Cavusgil et al., 2003; Hansen, 1999; Nonaka & Takeuchi, 1995) and in the field of communication media studies (Carlson & Zmud, 1999; Daft & Lengel, 1986; Dennis et al., 2008; Kock, 2004). Tacit knowledge transfer success was conceptualised based on Argote and Ingram (2000), and the structural model was developed based on Media Synchronicity Theory (Dennis et al., 2008).

This study focuses on tacit knowledge transfer activity at an individual level, in particular, the transfer of tacit knowledge between a participant and one of the participant's colleagues. Both quantitative data and qualitative data were collected, with the quantitative data used to test the hypotheses of the study and the qualitative data used to gain a better understanding of the underlying mechanisms. The population of this study were university teachers (university employees involved in teaching students) in New Zealand; the population is described in detail in section 4.3.2.

1.5 Significance of the study

The study contributes to the field of knowledge management and knowledge management systems by exploring the consequences of media choice for tacit knowledge transfer between individuals. The research model, based on the media synchronicity theory includes the success of tacit knowledge transfer, personal relationship factors, and media choice. By examining the connections between personal relationship strength, communication media selection, and tacit knowledge

transfer success, this study explores the implication of MST in the field of knowledge transfer.

This study contributes to practice by highlighting the effect of media choice on the success of tacit knowledge transfer. The findings of this study are of relevance for top management involved in developing knowledge management systems, IS systems, or communication systems in an organisation.

1.6 Summary of research method

A mixed research method was employed in this study. First, quantitative data were collected via both an online and paper based survey of university teachers in New Zealand universities to test the structural model, and then qualitative data were collected via semi-structured interviews to gain a deeper understanding of the reasons behind the relationships found to be significant.

Measures of the constructs involved in the structural model were adapted from prior empirical studies. To assess personal relationship, measurements from Carlson and Zmud (1999) as well as McKnight, Choudhury, and Kacmar (2002) were adapted. Measurement of media choice was developed based on MST as well as studies related to MST such as Kock and Lynn (2012) and Ryoo and Koo (2010). Measurement of tacit knowledge transfer success was adapted from Ko, Kirsh, and King (2005) as well as Szulanski (1996). Semi-structured interviews were conducted with survey participants who indicated that they were willing to be interviewed, with interview schedules taking into account the participants' input in the initial survey. The interview transcripts, along with answers to the open-ended questions in the survey, were treated as qualitative data and were analysed following procedures from Patton (2002).

1.7 Structure of the thesis

This thesis is structured as follows. Chapter 1 presents the background of the study, the research problem, and the overall research method. Chapter 2 presents a literature review covering tacit knowledge transfer, communication media theories, and the implication of communication theories in tacit knowledge transfer studies. Chapter 3 introduces the research model and hypotheses, which is developed based

on the theoretical foundation of tacit knowledge transfer and MST. Chapter 4 presents the research method, including the approaches used to obtain and analyse both quantitative and qualitative data. Chapter 5 presents the findings of the quantitative data analysis and the result of the structural model testing. Chapter 6 discusses the findings of the qualitative data analysis. Chapter 7 concludes the thesis by discussing the findings and stating the contribution and implications of this study.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review. Firstly, the conceptualisation of knowledge and tacit knowledge is discussed, followed by a summary of factors that influence tacit knowledge transfer. As the theoretical foundation for this study, two important communication media theories, Media Richness Theory and Media Synchronicity Theory, are presented along with their application to knowledge transfer. Finally, the interaction between personal relationships and communication media is discussed.

2.2 Knowledge

The nature of knowledge and its relationship with justification, truth and belief is a long lasting argument in the field of epistemology. This can be traced back to the disagreement between Plato and Aristotle regarding the nature of knowledge. For Plato, the physical world is "a mere shadow of the perfect world of 'idea', that cannot be known through sensory perception but only through pure reasoning" (Nonaka & Takeuchi, 1995, p. 22). For rationalists following Plato's theory, knowledge is justified true belief. It is objective, absolute, and is expressed in the forms of logic. Aristotle suggests ideas cannot be isolated from a physical object, and it depends on perceptual senses (Nonaka & Takeuchi, 1995). Philosophers who subscribe to empiricism see knowledge from a subjective view, and believe that knowledge is derived from human perception.

Subsequent philosophers brought together the two streams of rationalism and empiricism. The eighteenth-century German philosopher Immanuel Kant (1965) agreed that knowledge begins with experience, but did not agree that experience is the only source of knowledge. In Kant's view, knowledge is the outcome of the combination of logical sense and sensory experience (Nonaka & Takeuchi, 1995). Based on Hegel's dialectical idealism, Karl Marx emphasized the interaction between the subject (the knower) and the object (the known), and proposed that both subject

and object are in a continual and dialectical process of mutual adaptation in the pursuit of knowledge (Nonaka & Takeuchi, 1995).

The definition of knowledge is an on-going argument. In the field of information systems, the concept of knowledge can be understood by distinguishing it from data and information. Knowledge is often considered as a part of a hierarchy consisting of data, information, knowledge, and wisdom (Ackoff, 2010; Ancori, Bureth, & Cohendet, 2000; Bellinger, Castro, & Mills, 2004; Tuomi, 1999) (See figure 2.1).

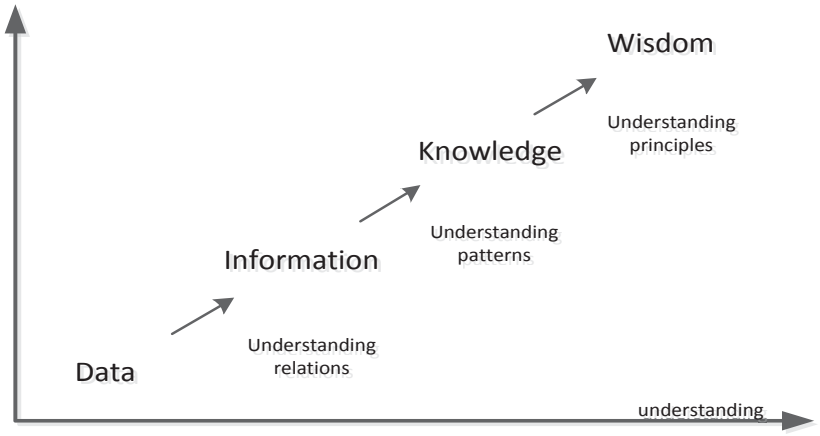

Figure 2.1. A hierarchy consists of data, information, knowledge, and wisdom. Adapted from "From data to wisdom," by R. Ackoff, 1989, *Journal of applied systems analysis*, 16, 3-9

Most sources define the concept of data in a similar way. Data are simple facts, symbols or observations with no meaning on their own; they can be captured and stored in a mechanical and computational manner (Bellinger et al., 2004; Zack, 1999). For example, numbers can be recorded on paper or in a computer system; they are not able to be understood or interpreted without knowing the context within which they were collected.

Researchers agree that Information is produced by organising data with meaningful connections (Bellinger et al., 2004; Zins, 2007). For example, a histogram could present the population growth for a period of time, or, a pie chart could show the age distribution of the current population.

Nonaka and Takeuchi (1995, p. 58) define knowledge as "a dynamic human process of justifying personal belief towards the truth". However they also emphasize the

role of the "knower", and suggest that knowledge is generated from information, anchored in the beliefs and commitments of the knowledge holder. Roberts (2000, p. 430) defines knowledge as the "application and productive use of information" which "involves an awareness or understanding gained through experience, familiarity or learning". Alavi and Leidner (1999, p. 6) conceptualise knowledge as "information possessed in the mind of the individual: it is personalised or subjective information related to facts, procedures, concepts, interpretations, ideas, observations, and judgements (which may or may not be unique, useful, accurate, or structural)."

Ryle (1949) argues that there is a distinction between intelligence or "knowing how" and having knowledge or what he calls "knowing that". There is a difference between knowing that something is so and knowing how to do something. He believed the workings of the mind were not separate from the body. Ryle (1949, p. 16) points out "Effective possession of a piece of knowledge that involves knowing how to use that knowledge, when required, for the solution of other theoretical or practical problems". This is similar to Michael Polanyi's (1966) idea about tacit knowledge where he argues that a large part of knowledge can be obtained and used without being aware of it. Polanyi suggested that such knowledge is embedded in the context, which can only be known when it influences people's articulated knowledge, and called it tacit knowledge.

All the above conceptualisations state that knowledge exists in the human mind, and it is personalised and context specific. However some researchers argue that knowledge is not only stored in the mind of individuals, but also exists in organisations. Argote and Ingram (2000) suggest while individual knowledge is anchored within the human mind, organisational knowledge is embedded within the technology structure, norms, and routines.

Perhaps the conceptualisation provided by Davenport and Prusak (2000, p. 4) is the most comprehensive and clear. They suggest that knowledge is "a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It

originates and is applied in the minds of the knower. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms." According to this, what distinguishes knowledge from information is the involvement of the human mind. The human mind is capable of transforming information into knowledge and vice versa (Alavi & Leidner, 1999). It is common to see communication media studies use the term information and knowledge interchangeably without a clear differentiation (Hasty, Massey, & Brown, 2006; Ryoo & Koo, 2010; Yoo & Alavi, 2001). Instead of studying the transfer of explicit/tacit knowledge transfer, these studies discussed the transfer of lean/rich information (further discussed in section 2.5).

While wisdom is considered to be of highest value and at the top of the hierarchy, it is usually neglected because it is a complete mental concept that is difficult to define or express (Takahashi & Bordia, 2000).

Ackoff (2010) suggests that the transformation of data to information involves the "understanding of relations", the transformation of information to knowledge the "understanding of patterns", and the transformation of knowledge to wisdom the "understanding of principles". The value and the involvement of the human mind increases as you move from the lower to higher levels of the hierarchy.

While the Data-Information-Knowledge-Wisdom hierarchy is widely accepted and studied in information management and knowledge management research (Bellinger et al., 2004; Tuomi, 1999), it has been criticised as being too simplistic. It is sometimes argued that the relationship between information and knowledge is interactive. On the one hand, knowledge is derived from the accumulation of information; on the other hand, it guides and directs the collection of such information (Ancori et al., 2000). Also, Watson (2003) argues that knowledge is context specific. With no prior knowledge of the context, one will not be able to transform data into information, and information into knowledge. He illustrated this by the following example: "the **states of nature** indicated by red, amber, and green traffic lights may not be seen as informative to Bushmen of the Kalahari. Yet they in

turn may perceive certain patterns in the soil as indicative of the presence of lions nearby." (Watson, 2003, p. 13).

The conceptualisation and the nature of knowledge remains an on-going debate due to different philosophical and psychological views. Despite this, a large number of knowledge studies in the field of information systems to date have focused on the epistemological dimension of knowledge, that is explicit knowledge and tacit knowledge (Cowan, David, & Foray, 2000; Leonard & Sensiper, 1998; Nonaka & Takeuchi, 1995).

2.3 Tacit Knowledge

2.3.1 Conceptualisation of tacit knowledge

The distinction between explicit and tacit knowledge was first introduced by Polanyi (1966), then was expanded by Nonaka and Takeuchi (1995). It is generally agreed that explicit knowledge is that which can be codified, recorded, and transmitted in formal and systematic languages. Therefore it can be effectively managed using information systems (Nonaka & Takeuchi, 1995; Zack, 1999). It can be embedded in the form of data, operational manuals, documents or videos, frameworks, sets of principles, instructions, and so on (Leonard & Sensiper, 1998; Roberts, 2000). Explicit knowledge is often considered to be "the tip of the iceberg" (Haldin-Herrgard, 2000; Leonard & Sensiper, 1998; Nonaka & Takeuchi, 1995), while tacit knowledge is the large part that lies beneath the water line.

Tacit knowledge is often compared to explicit knowledge in order to conceptualise the distinction (see table 2.1). While explicit knowledge is knowing-that, tacit knowledge is knowing-how (Polanyi, 1966); while explicit knowledge is objective, tacit knowledge is subjective (Nonaka & Takeuchi, 1995); while explicit knowledge involves declarative knowledge, tacit knowledge involves procedural knowledge (Anderson, 1996). Researchers characterise tacit knowledge as personal and context specific, difficult to articulate, both visible and invisible to the holder; it involves skills, beliefs, values, experience, and know-how (Cowan et al., 2000; Leonard & Sensiper, 1998; Nonaka & Takeuchi, 1995).

Table 2.1

A comparison of explicit and tacit knowledge

Explicit knowledge	Tacit knowledge	Source
Knowing-that	Knowing-how	(Polanyi, 1966; Ryle, 1949)
Objective	Subjective	
There and then	Here and now	(Nonaka & Takeuchi, 1995)
Declarative	Procedural	(Anderson, 1996)

2.3.2 The tacit and explicit dichotomy

Although tacit knowledge has been extensively studied, dichotomies exist in the literature. One of the main dichotomies is whether tacit and explicit knowledge are integral parts of knowledge, or whether they are two categories of knowledge.

Nonaka and Takeuchi (1995) view explicit knowledge and tacit knowledge as two categories of knowledge, where the former is distinguished from the latter by its codifiability. Explicit knowledge can be transmitted into formal and systematic language. It is about past events or objects, and it can be acquired and transferred without contextual information, whereas tacit knowledge concerns experiences from a specific, practical context (Nonaka & Takeuchi, 1995).

On the other hand, researchers suggest that Nonaka and Takeuchi's theory over-simplifies the concept of tacit knowledge (Brown & Duguid, 1998; Tsoukas, 2005). According to Polanyi (1966, p. 195), there is no clear distinction between tacit and explicit knowledge: "The idea of a strictly explicit knowledge is indeed self-contradictory; deprived of tacit coefficients, all spoken words, all formulae, all maps and graphs, are strictly meaningless"; even the most objective knowledge – scientific knowledge involves tacit thoughts (Polanyi, 1966).

Based on Polanyi's theory, Tsoukas (2005) suggests that tacit knowledge cannot be separated from all knowledge. Articulated knowledge, such as documents and blueprints, can only make sense to an individual when it is combined with that individual's tacit knowledge. This is supported by Ribeiro's (2012) observation of tacit knowledge management practice in a Brazilian industrial plant. Ribeiro found that a standard operation manual required workers to have had previous experiences in order for the manual to be of use in a real life situation. Therefore,

tacit knowledge is rooted in all knowledge, tacit and explicit are two dimensions of knowledge, rather than two different categories of knowledge (Brown & Duguid, 1998; Polanyi, 1966; Tsoukas, 2005).

2.3.3 The tacitness of policy knowledge

Robbins and Coulter (2007, p. 166) define policy as a "guide that established parameters for making decisions", which usually "contains ambiguous terms that leaves interpretation to the decision makers". In an organisation, policies are used to set direction, to place a restriction on what members may or may not do, and enable the implementation of organisational strategies (Luckett, 2003). Because documents describing the policy often contain unclear and ambiguous terms, researchers in the field of policy studies suggest that knowledge about interpreting and implementing policy is highly tacit (Spillane, Reiser, & Reimer, 2002; Yanow, 1996).

2.3.3.1 The tacit understating of policy meanings

Yanow (2000) argues that the meaning of a policy is conveyed to its audiences through symbols, that can be in the form of language, objects and acts. She argues that a symbol may have different meanings for different groups of people based on their values, beliefs, and feelings; the symbol makes sense only when members in a particular group agree on the meaning it embodies. The development of the meaning of a symbol is often historically and contextually specific. She illustrated her point by an example: a dove is a symbol of peace for some people but is simply a bird or even a meal for others. She suggests that policies are written in the form of texts, which are a type of symbolic artefact. Employing literary theory, she argues that the meaning of text is "created actively in interactions among all three [the author, the text, and the reader], in the writing and in the reading" (Yanow, 2000, p. 17). Arguing that policy is the text and the people involved in and affected by the policy are the readers, Yanow suggests that policy the artefact is open to multiple interpretations (Yanow, 1996, 2000).

The interpretation and implementation of policy requires tacit knowledge from individuals. Policy is ambiguous and unclear in nature; it may hold different

meanings for different audiences. Policy actors have to tacitly understand the meaning of the policy in order to successfully implement the policy (Yanow, 2000).

2.3.3.2 Tacit knowledge of individuals

Spillane et al. (2002) argue that people interpret and implement a policy based on the interaction between their cognitive structure (which includes their knowledge, beliefs, and attitude), the situation, and the policy fit to their agendas, interests, and resources. Summarising prior studies that explored the implementation of teaching policy, Spillane et al. (2002) found that there were similar findings among these studies. When making sense of and implementing a policy, teacher's prior knowledge, experience, values, and beliefs about subject matter, teaching, students, and learning influenced their interpretation of that policy. As a result, teachers may interpret and implement the same policy very differently.

Studying public management policy and practice in Western China, Chan and Chow (2007) found that local government officials understood the norms, values, commandments and taboos of their work place based on their tacit knowledge. With this tacit knowledge, they could understand the meaning of policy, and more importantly the intent of their superiors, accurately, which enabled them to survive under the policy and even benefit from the policy.

2.3.3.3 Tacit thinking about the situation

To successfully implement a policy, people sometimes have to make decisions based on their understanding of the situation. Hier and Walby (2013) studied the deployment of public camera surveillance of special events in Canada. They found that when public safety policy conflicted with privacy policy, the people who were implementing the policy made decisions that relied on their tacit understanding about the situation. The researchers concluded that the meaning of a policy was communicated in situation-specific contexts. How the policy was interpreted and further implemented was based on individuals' tacit assumptions about security, public safety, and risk management. Agreeing with Yanow (2000), they argue that the meaning of a policy has to be understood tacitly therefore the interpretation and

implementation of policies are influenced by individuals' tacit knowledge concerning the need of the moment.

In summary, to interpret and implement a policy, people have to rely on their tacit knowledge which includes experiences, values, and beliefs, to understand the meaning of the policy and to make decisions in a particular situation. When people exchange ideas about a policy, what they are actually exchanging are their experiences, knowledge, values, and beliefs towards the policy, in other words, they are transferring tacit knowledge.

2.4 Factors that influence tacit knowledge transfer

Knowledge transfer can be defined at both the individual level and organisational level as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote & Ingram, 2000). Because tacit knowledge is of high value and conceptually more complex than explicit knowledge, the transfer of tacit knowledge is one of the most popular topics in the field of knowledge management (Ribeiro, 2012; Tsoukas, 2005). Researchers have investigated the factors that influence tacit knowledge transfer. This study summarised these factors into five categories, namely: tacit knowledge characteristics, knowledge provider/source, knowledge recipient, similarities, relationship, and organisational context (see table 2.2).

Table 2.2

Factors that influence tacit knowledge transfer

Factors	Studies
Tacit knowledge characteristics	
Tacitness	Nonaka &Takeuchi (1995)
Ambiguity and uncertainty	Szulanski (1996)
Perception, language, time, value, distance	Haldin-Herrgard (2000)
Knowledge provider/source	
Knowledge power	Orlikowski (1992); Davenport & Pruzak (2000)
Opportunity cost	Orlikowski (1992)
Reward	Davenport & Pruzak (2000); Leonard & Sensiper (1998)
Knowledge recipient	
Trustworthiness of knowledge	Szulanski (1996)
Motivation	Simonin (2004); Scott & Sarker (2010)
Absorptive capacity	Cohen & Levinthal (1990); Lane & Lubatkin (1998)
Similarities between knowledge provider and recipient	
Common language	Madhavan (1998); Nahapiet & Ghoshal (1998)
Personal relationship between knowledge provider and recipient	
Tie strength	Hansen (1999); Reagans & McEvily (2003)
Trust	Davenport & pruzak (2000); Roberts (2000)
Organisational context	
Organisational culture	Ajmal and Koskinen (2008); Joia and Lemos (2010)
Knowledge management strategy	Hansen, Nohria, and Tierney (2000)
Information and communication technology	Roberts (2000); Murray & Peyrefitte (2007)

2.4.1 Tacit knowledge characteristics

The degree of knowledge tacitness influences knowledge transfer. A number of researchers suggest tacit knowledge can be converted into explicit knowledge. For example, Nonaka and Takeuchi (1995) believe that knowledge is created and expanded through social interaction. In their SECI model, they propose four modes

of knowledge conversion; socialisation (tacit to tacit), externalisation (tacit to explicit), combination (explicit to explicit), and internalisation (explicit to tacit) (See figure 2.2). This model emphasises the importance of socialisation in the transfer of tacit knowledge and shows that not only can explicit knowledge be internalised to create tacit knowledge, tacit knowledge can be converted into explicit knowledge through a process including metaphor and model development (Nonaka, 1994; Nonaka & Takeuchi, 1995). They argue that the shifts of the four modes of knowledge conversion shape a spiral process, through which the continuous and dynamic interaction between tacit and explicit knowledge creates new knowledge for organisations (Nonaka & Takeuchi, 1995).

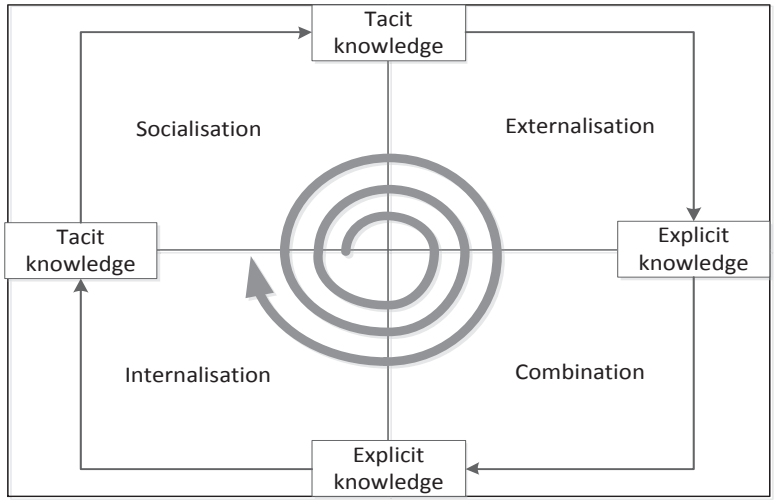

Figure 2.2. Knowledge creation model consists of four modes: socialisation, externalisation, combination, and internalisation. These four modes shape a spiral interaction between tacit and explicit knowledge. Adapted from "Theory of organisational knowledge creation," by Nonaka and Takeuchi, 1995, *Knowledge Creating Company*, p. 62. Copyright by Oxford University Press, Inc.

Others argue that converting tacit knowledge into explicit knowledge is neither achievable, nor necessary. According to Polanyi (1966), tacit and explicit exist on a continuum, and while some knowledge is high in tacitness, other is high in explicitness. He argues that even the most explicit knowledge involves tacit thinking, and it is impossible to remove the tacit element from any knowledge. Tsoukas (2005) argues that knowledge contains an ineffable element that is based on an act of personal insight, and such an element is essentially inarticulable. Brockmann and Anthony (1998) argue that tacit knowledge can only be learnt, while Haldin-Herrgard

(2000) suggests that tacit knowledge can be transferred through experience and practice and through interaction with other individuals.

Despite the debate over the distinction between explicit and tacit knowledge, it is generally agreed that tacitness is one of the major barriers of knowledge transfer success (Davenport & Pruzak, 2000; Nonaka & Takeuchi, 1995; Szulanski, 1996). While explicit knowledge can be transferred easily using information technology or more traditional ways such as letters and memos, tacit knowledge transfer cannot be easily achieved. Szulanski (1996) suggested that because tacit knowledge is often embedded in human skills and experiences it can be seen as being high in ambiguity and uncertainty which contributes to its "stickiness", thus making it more difficult to transfer.

Hansen (1999) suggests that knowledge differs in codifiability. He found that because it can be codified, explicit knowledge was much easier to transfer than tacit knowledge. Haldin-Herrgard (2000) summarised the difficulties of sharing tacit knowledge as follows: perception (people may not be aware of the full range of their knowledge), language (people may not able to express their tacit knowledge), time (sharing tacit knowledge requires a long time), value (some forms of tacit knowledge such as intuition may not be considered as valuable), and distance (the physical distance between individuals hinders interaction).

2.4.2 The knowledge provider/source

The knowledge provider may refuse to transfer their knowledge due to the fear of losing power or due to high opportunity costs. There are some researchers that argue employees consider knowledge as a source of power within the organisation (Orlikowski, 1992), leading to a reluctance to share knowledge with others due to their fear of losing the power their knowledge gives them (Davenport & Pruzak, 2000; Gray, 2001). Because of its complexity, the transfer of tacit knowledge is time consuming for both the knowledge source and the knowledge recipient. When there is a high opportunity cost such as the amount of time that must be invested in the transfer of knowledge the knowledge provider may refuse to participate (Orlikowski, 1992). Additionally, Social Exchange Theory suggests that people are

more likely to engage in tacit knowledge transfer activity willingly when the benefit of the transfer is perceived to be more valuable than any negative outcome (Muthusamy & White, 2005; Sveiby, 2007).

For these reasons it is suggested by some that if knowledge sources were rewarded, they would be more willing to share their knowledge (Davenport & Pruzak, 2000). For example, a performance review system that takes knowledge sharing into consideration and financially rewards and penalises employees according to their knowledge sharing behaviour may contribute to an environment where sharing knowledge is considered positive (Leonard & Sensiper, 1998).

2.4.3 The knowledge recipient

The reliability of the knowledge source is also a major element that influences knowledge transfer. If the knowledge of the provider is not considered trustworthy, then the knowledge transfer activity is likely to be resisted and challenged (Szulanski, 1996). Szulanski (1996) also suggests that a recipient's motivation to seek knowledge, and their absorptive capacity, are two significant barriers to knowledge transfer. Motivation refers to the willingness of the recipient to learn from a source, a partner, or even to participate within a collaborative environment (Simonin, 2004). A number of studies confirm that the knowledge recipient's lack of motivation could significantly affect internalisation of new knowledge, and therefore hinder knowledge transfer (Joshi, Sarker, & Sarker, 2007; Scott & Sarker, 2010).

Absorptive capacity refers to the knowledge recipient's ability to recognise the value of knowledge. This then impacts on their desire to acquire, assimilate , transform and exploit knowledge (Cohen & Levinthal, 1990; Todorova & Durisin, 2007). Lack of absorptive capacity decreases the knowledge recipients' ability to discover and recognise new knowledge, and reduces their ability to assimilate or transform it into new knowledge (Lane & Lubatkin, 1998; Lane, Salk, & Lyles, 2001; Scott & Sarker, 2010).

2.4.4 Similarities between the knowledge provider and knowledge recipient

A major factor found to influence tacit knowledge transfer is language. First of all, because tacit knowledge is deeply embedded in human actions, the higher the

tacitness the greater the difficulty in converting that knowledge into language (Haldin-Herrgard, 2000). Even when tacit knowledge can be converted into language, the diversity of terminologies and jargon creates difficulties for the transfer of such knowledge among people within different occupational groups (Davenport & Pruzak, 2000; Haldin-Herrgard, 2000).

Language similarities between the knowledge source and recipient facilitate tacit knowledge transfer. Having a common language means sharing a set of codes, terms, symbols and understandings that allow people to communicate effectively (Nahapiet & Ghoshal, 1998) and therefore facilitate the transfer of knowledge (Collins & Smith, 2006). Madhavan (1998) suggests a common language, along with shared prior knowledge, could result in shared mental models, which further facilitates tacit knowledge transfer.

2.4.5 Relationship strength between the knowledge provider and knowledge recipient

According to Nonaka and Takeuchi (1995) tacit knowledge can only be exchanged through interaction between individuals. They consider socialisation including "joint activities - such as being together, spending time, living in the same environment" as the key to transferring tacit knowledge (Nonaka & Konno, 1998, p. 42). People develop relationships during social interaction, and the effect of relationships on tacit knowledge transfer has been extensively studied (Bouty, 2000; Hansen, 1999; Levin & Cross, 2004).

Relationship is a multilevel and multidimensional concept. In the field of knowledge management, the effect of relationships on knowledge transfer success at both organisational level (Minbaeva, 2007; Smith, Collins, & Clark, 2005; Szulanski, 1996) and individual level (Bouty, 2000; Levin & Cross, 2004; Reagans & McEvily, 2003) has been explored. It has been demonstrated that a strong relationship, which consists of strong ties (Bouty, 2000; Hansen, 1999), frequent interaction (Cavusgil et al., 2003; Levin & Cross, 2004), cumulative experience (Hasty et al., 2006), and a high level of trust (Chiu, Hsu, & Wang, 2006; Levin & Cross, 2004) between individuals positively affects tacit knowledge transfer.

The strength of ties between the knowledge source and recipient significantly influence knowledge transfer. Hansen (1999) found that “weak ties” (infrequent communication, a distant relationship and low reciprocity of services) between the knowledge source and receiver facilitated the search for useful knowledge, and shortened a project’s completion time, when knowledge was not complex. However, when the knowledge is complex, strong ties (frequent communication, a close relationship and a high reciprocity of services) between the knowledge source and recipient facilitate the transfer (Bouty, 2000; Hansen, 1999). Similarly, Cavusgil et al. (2003) found that a close relationship aids in the transfer of tacit knowledge, and therefore improves the innovation capability of a firm. Based on Carlson and Zmud’s (1999) Channel Expansion Theory (discussed further in section 2.6), Hasty et al. (2006) found that cumulative experience in communicating with each other helps individuals to develop a mutual understanding, which improves the efficiency of communication and further enables knowledge transfer.

Researchers stress the importance of trust between the knowledge source and knowledge recipient in knowledge transfer studies. Trust refers to a set of beliefs towards another party’s integrity, benevolence, and ability (Chiu et al., 2006; Mayer, Davis, & Schoorman, 1995). A high level of trust between individuals influences tacit knowledge transfer by lowering the level of risk and uncertainty (Davenport & Pruzak, 2000; Roberts, 2000). As Roberts (2000, p. 434) said, “Trust and mutual understanding developed in a social and cultural context are prerequisites for tacit knowledge transfer”.

Levin and Cross (2004) found that strong personal relationships led to a high degree of trust between individuals, and a high degree of trust positively affected knowledge transfer success. When there is a high degree of trust, the knowledge source feels secure when sharing knowledge (Joia & Lemos, 2010), the knowledge recipient is more likely to rely on the knowledge received from the source (Chiu et al., 2006), and people are more willing to engage in knowledge transfer activities (Nahapiet & Ghoshal, 1998).

2.4.6 Organisational context

Organisational context influences knowledge transfer by its structure and systems, sources of coordination and expertise, and behaviour-framing attributes (Szulanski, 1996). Ajmal and Koskinen (2008) argue that knowledge management is not only about transferring and creating knowledge, it is also about creating an organisational culture that facilitates and encourages the creation, sharing, and utilisation of knowledge. They suggest it is important to shape an organisational culture to accept, adopt, and utilise knowledge transfer activities. When organisational activities are heavily reliant on chain of command, job specification, and standard procedures, the availability of time, flexibility, and close interactions required for tacit knowledge transfer is limited (Joia & Lemos, 2010).

In order to gain a competitive advantage, an organisation needs to match its knowledge management strategy with its core values. Two strategies to facilitate knowledge transfer within organisations are codification and personalisation (Hansen et al., 2000). While a codification strategy focuses on the capturing, storing, and transmitting of explicit knowledge using information systems, the personalisation strategy focuses on how an organisation facilitates tacit knowledge transfer by arranging the organisational resources (e.g., IT resources, human resources) to promote person-to-person interactions (Hansen et al., 2000).

2.5 The effect of communication media on tacit knowledge transfer

While it is generally agreed that the use of information and communication technology (ICT) significantly improves the efficiency of explicit knowledge management (Hansen et al., 2000; Zack, 1999) some researchers argue that tacit knowledge transfer can also be assisted when organisations use ICT properly (Cavusgil et al., 2003; Daft & Lengel, 1986; Murray & Peyrefitte, 2007; Roberts, 2000). Several theories are developed to determine the effect of media use on communication performance, and these theories have been applied by a number of researchers to explore how organisations could benefit from ICT to promote tacit knowledge transfer.

A number of theories attempt to explain media use and communication performance, the most popular and the most accepted among which are Media Richness Theory and Media Synchronicity Theory.

2.5.1 Media Richness Theory and Related Studies

New communications media such as video conferencing, instant messaging, and email are widely used in organisations along with traditional methods. In order to help individuals choose the most efficient media to use it is important to determine the effectiveness of the various options available on communications. Media Richness Theory (MRT) was proposed by Daft and Lengel (1986) and is one method that provides theoretical foundations for studying the use of new communications media. Subsequent extensions of MRT approach communications media use from different perspectives such as the symbolic meanings of media (Trevino, Lengel, & Daft, 1987), social influence theory (Fulk & Boyd, 1991), adoptive structuration theory (DeSanctis & Poole, 1994), and channel expansion theory (Carlson & Zmud, 1999).

2.5.1.1 Media Richness Theory

According to MRT (Daft & Lengel, 1986), an organisation is an open social system, and its success is based on its ability to process information in order to reduce uncertainty. Managers within this social system exchange, interpret and process information between each other in order to make decisions, and communication performance can be improved by matching media characteristics with information processing tasks.

There are two forces that influence information processing - uncertainty and equivocality. Uncertainty is the difference between the amount of information required to perform the task and the amount of information already possessed by the organisation (Daft & Lengel, 1986). The greater the uncertainty of a task, the greater the amount of information that has to be processed (Galbraith, 1977). When dealing with a task with high uncertainty, managers do not have sufficient information to make decisions to solve the task. Also, a task may have high analysability or high equivocality. Task analysability is the application of objective,

well understood procedures or routines for a particular situation or problem, whereas equivocality means ambiguity, or the existence of multiple interpretations and understandings of a situation (Daft & Lengel, 1986). When dealing with a task with a high level of equivocality, a decision cannot be made by following procedures or manuals. A person's experience and judgement, based on tacit knowledge, is required. While the level of uncertainty can be reduced by obtaining a large amount of relevant information, the level of equivocality can be reduced by information **richness** which is "the ability of information to change understanding within a time interval" (Daft & Lengel, 1986, p. 560).

Communications where a common understanding between individuals can be established within a short period of time is considered high in richness, whereas communications which require a long period of time to achieve a common understanding are considered to be lower in richness. Communications media differ in richness according to their ability to provide immediate feedback, the amount of personalisation, the number of channels and cues, and the variety of the language used (Daft & Lengel, 1986).

Based on their richness, Daft and Lengel (1986) suggest that communication media can be classified in a decreasing order or richness, ranging from face-to-face communications, telephone calls, video conferences, letters, memos and other written documents, to numeric documents such as spreadsheets. Face-to-face communication is the richest because it provides immediate feedback. Therefore the interpretation of transmitted information can be immediately confirmed.
Face-to-face communication also allows for a variety of different cues to be incorporated including body language and gestures as well as tone of voice. Rich communications reduce the level of equivocality by allowing people to overcome different frames of reference and providing them with the ability to process complex and subjective messages (Daft & Lengel, 1986). While the use of rich communications media leads to better performance of equivocal tasks, the use of lean communications media such as memos and letters leads to better performance of tasks with high analysability.

2.5.1.2 Inconsistencies among empirical studies of MRT

MRT set up a theoretical foundation for communications media studies. However, studies of MRT have inconsistent results, and some researchers have questioned the reliability of MRT when explaining the effect of ICTs on communications performance.

Because computer mediated communications were not available at the time when MRT was developed, they were not included in Daft and Lengel's (1986) classification of richness. But these new media were retroactively fitted into the framework by later researchers (Dennis et al., 2008). MRT predicts media performance, and suggests that managers who use richer media for equivocal tasks have improved performance over those who use leaner media for the same tasks. However, the majority of studies involving MRT have tended to focus on the choice of the media, rather than on how the media performs (Dennis & Kinney, 1998), and these studies produced mixed and confusing results.

Some studies have found that richer media is used for equivocal tasks and leaner media for simple tasks (Daft, Lengel, & Trevino, 1987; Kraut, Galegher, Fish, & Chalfonte, 1992; Walther, 1995). Where King and Xia (1997) found that students preferred using richer media such as face-to-face conversations, group meetings and telephone conversations in their learning activity, other studies suggest that the media richness is not the only influencing factor. For example, Markus (1994) found that email tended to depersonalise communications because it was asynchronous and it filtered personal and social cues such as body language and facial expressions. Thus people tended to prefer email when they did not want/need personal interaction. She concluded that social effects had a significant influence on the choice of communication media.

Not only does the effect of media richness on media choice have mixed results, but the effect of media richness on communication performance is also unclear. While Rice (1992) found that using richer media for equivocal tasks led to better performance, Dennis and Kinney (1998) found such a relationship was not significant. When studying the effect of media richness on decision making, they found that

matching media richness and task equivocality did not lead to better task performance.

As a result of this inconsistency of research results, researchers argued about whether people always chose richer media over leaner media when dealing with equivocal tasks. And secondly did the “fit” between media richness and task characteristics always lead to better communication performances? As a result of these questions and to gain a deeper understanding of media use and media performance, a number of theories were developed based on MRT.

2.5.1.3 The subsequent theories of MRT

Trevino, Lengel and Daft (1987) proposed a symbolic interaction extension to MRT. They found that the factors that influence people’s media choices were message ambiguity, symbolic cues and situational determinates such as time and distance. People often chose to use written messages over face-to-face communications when they wished to convey information about formal authority, competency or legitimacy. They argued that some media carry symbolic meanings beyond the message itself, and therefore media choice may be based on the symbolic meanings of the media rather than its richness.

In their Social Influence Theory, Schmitz and Fulk (1991) argued that richness was not the objective property of a media. They suggest that media richness is partly socially constructed, and therefore different individuals may have different perceptions of the richness of a particular media. This perception may then affect individuals’ media choice. For example, one individual may see email as a leaner media and only use it to deliver text messages, where another may use it as a richer media because of the layout, the type of font, capitalisation, the use of emoticons etc.

Communications media that are able to support colocation, synchronicity, the exchange of speech, the use of facial expressions, and the use of body language have a high degree of “naturalness” (Kock, 2004). Less cognitive effort is necessary to interpret a message delivered through a medium with a higher degree of naturalness (e.g., video-conference), than with a lower degree of naturalness (e.g., mail).

However, familiarity with the media and the communication partner, as well as experience with the communication task, lead to the establishment of a mental schema (a shared mental framework) between individuals that reduces the effort of interpreting a message. Channel Expansion Theory (Carlson & Zmud, 1999) suggests that perceived richness is related not only to the characteristics of the media, but also to the users' experience with the media, the experience between communication partners, familiarity with the communication task and the context in which the communication occurs.

Personal relationships are an important factor in the communication process. The development of personal relationships requires more time when individuals are not using face-to-face interactions, but given sufficient time, strong personal relationships can be established even by using lean media (Walther, 1992).

2.5.2 Media Synchronicity Theory and related studies

Media Synchronicity Theory (MST) is different to MRT and its extensions in several aspects. First of all, MRT focuses on the equivocality and the complexity, that is, the characteristics of the task, whereas MST focuses on the communication processes required to resolve a task. Secondly, in terms of media characteristics, according to MRT, media are different in terms of richness, whereas in MST media have different capabilities supporting synchronous communication. Finally, context is neglected in MRT, whereas it is considered an important aspect in MST. The following sections discuss MST and its difference to MRT in detail.

2.5.2.1 Underlying communication processes

MST was developed to explain the relationship between media characteristics and communication performance. MST argues that MRT and its extensions over stressed the importance of "task". Instead of looking at the type and characteristics of the "task", researchers should rather focus on the underlying communication processes required when solving a task (Dennis & Valacich, 1999). It is not the "fit" between media characteristics and task type (level of uncertainty and equivocality) that influences communication performance, but the "fit" between the communication processes (required by the task), media capability (supporting information

transmission and information processing), and cumulative experiences (on the media, the task, and with the communication partner) that matter.

Communication is not only about the transmission of information, but also about individuals making sense of the transmitted information (Miranda & Saunders, 2003).There are two fundamental processes that must be performed to accomplish a communication task, namely conveyance of information, and convergence of meaning (Dennis et al., 2008)

The conveyance processes involve the transmission of information in various formats (such as text, numbers, pictures, etc), and the processing of such information so that individuals can understand it. In conveyance processes, individuals need time to process and make sense of the gathered information.

The objective of convergence processes is to achieve agreement on the meaning of the information and the context, as well as the interpretation of such information in context between communication partners. Compared to conveyance processes, there is less information processing involved in convergence processes. They require the rapid exchange of short messages in both directions to reach mutual agreement.

Contrary to MRT, in MST the level of uncertainty and equivocality of a task is not important. Most tasks require both conveyance and convergence processes, although the proportion of these processes may vary. Without the conveyance of information, individuals will lack understanding of the context of the task, and without convergence, individuals will lack a shared understanding. Therefore they will not be able to make decisions or produce solutions for the task. Therefore, to investigate the influence of media characteristics on communication performance, it is important to explore how the use of media facilitates or constrains the two communication processes (Dennis et al., 2008).

2.5.2.2 Media characteristics

In MST convergence processes benefit from synchronicity while conveyance processes do not. Synchronicity is defined as “a state in which individuals are working together at the same time with a common focus”. The extent to which the

capabilities of a media enable individuals to achieve synchronicity is called media synchronicity (Dennis et al., 2008, p. 581).

According to Warren Weaver (1949, p. 2) the most basic communication problem is "how accurately the symbols of communication be transmitted?". For Weaver, information is not only the delivered message, but also the context of the communication. Weaver suggested that the capability of a channel (referred to as medium or media in different theories) is not measured by the number of symbols that can be transmitted by it, but rather by the volume of information that can be transmitted, and by what can be produced out of the transmitted information. Based on, and extending from, Shannon and Weaver's (1949) communication theory, Dennis, Fuller and Valacich (2008) suggest there are five media capabilities that influence the level of synchronicity. They are transmission velocity, symbol sets, parallelism, rehearsability, and preprocessability.

Transmission velocity is the speed at which a medium can deliver a message to intended recipients (Dennis et al., 2008). Messages that have a high transmission velocity are delivered to the recipient as soon as they are sent. In media theories developed before MST, communication benefits from high transmission velocity are often described as "immediate", "rapid", or "fast feedback". High transmission velocity helps people working together by enabling the development of shared focus and behaviour coordination, therefore positively affecting the level of synchronicity.

Symbol sets are the different ways in which a medium encodes information for communication (Dennis et al., 2008). In Media Richness Theory it is referred to as a cue or language variety (Daft & Lengel, 1986). People can use multiple symbol sets simultaneously to communicate with each other (e.g., body language, spoken words, and facial expressions can be used at the same time), and communications media differ in their capabilities to deliver the use of multiple symbol sets simultaneously (e.g., a variety of symbol sets can be used in face-to-face conversation, whereas only visual symbols can be used when sending emails). Symbol sets affect the level of synchronicity not by the number of symbol sets available, but by the naturalness of the symbol, and the fit between symbol set and task type.

Weaver (1949) suggested that messages have to be coded precisely to maximise the efficiency of information transmission. However the more precise the coding, the greater the effort individuals spend in encoding and decoding messages. Kock (2004) argues that symbol sets differ in the speed of encoding and decoding due to the different degree of "naturalness". Because messages with natural symbol sets (physical, visual, and verbal) are easier to be decoded than messages with unnatural symbol sets (written or typed), media that is able to deliver natural symbol sets are more capable of supporting synchronicity (Dennis et al., 2008).

When symbol sets match the requirements of the message, communication is more efficient because information can be more precisely encoded and decoded in one particular symbol set than another (Dennis et al., 2008). For example, when describing sales figures to a colleague, it is easier to demonstrate the data in the form of tables or charts than to describe them orally. Therefore, the "fit" between symbol sets and the message requirement leads to higher levels of synchronicity.

The number of simultaneous transmissions that can effectively take place is referred to as parallelism (Dennis et al., 2008). Media with high parallelism allow several communication threads to exist in a group discussion. By enabling multi-directional, simultaneous communication it reduces the shared focus among the group, thus negatively affecting the level of synchronicity. For example, when discussing two topics at the same time (e.g. group discussion on skype, email exchanges with more than one colleague at the same time), individuals' attention has to shift from one to another and therefore the speed of feedback is reduced.

Rehearsability refers to the ability of the sender to edit a message before sending it out so that it more precisely conveys the intended meaning (Dennis et al., 2008). Because more time is spent in editing the message, a time delay between message transmissions is created. Therefore rehearsability lowers the level of synchronicity.

Finally, reprocessability refers to the level of re-examination and re-processing that is possible either within the context of the communication or after the communication event has passed (Dennis et al., 2008). Similar to rehearsability there

is a time delay between message transmissions, which lowers the level of synchronicity.

These five media capabilities influence the level of synchronicity between individuals. Media with high transmission velocity and more natural symbol sets have greater support for synchronicity, while media with high parallelism, high rehearsability, and high reprocessability have less support for synchronicity.

Before publishing the 1999 version of MST, Dennis, Valacich, Speier, and Morris (1998) examined the effect of synchronicity on task performance, and provided preliminary support for MST. They found that participants using media that support low synchronicity (written communication) generated more unique ideas, whereas participants using media that support high synchronicity (face-to-face communication) were more likely to reach consensus and spend less time on the same task. They concluded that media low in synchronicity supported information conveyance, and media high in synchronicity supported convergence.

Based on the observation of, and interviews with, members of eight virtual business teams, DeLuca and Valacich (2006) concluded that media with lower synchronicity such as computer mediated communication led to better conveyance performance, whereas media with higher synchronicity such as face-to-face communication led to better convergence performance. Murthy and Kerr (2003) found that using media that supported higher synchronicity led to better performance in problem solving tasks, whereas using media supporting lower synchronicity led to better performance on idea generation tasks.

According to their physical characteristics, Dennis et al. (2008) compared the capabilities of some commonly available communication media to support synchronicity (see table 2.3).

Table 2.3

A comparison of selected media and their capabilities

Media	Media Capability					Communication process		Synchronicity
	Velocity	Parallelism	Symbol sets	Rehearsability	Reprocessability	Information transmission	Information processing	
Face-to-Face	High	Medium	Few-Many	Low	Low	Fast	Low	High
Video conference	High	Medium	Few-Medium	Low	Low	Fast	Low	High
Tele conference	High	Low	Few	Low	Low	Fast	Low	High
Instant messaging	Medium-high	Low- Medium	Few- Medium	Medium	Medium-high	Medium	Low- Medium	Medium
Email	Low-Medium	High	Few-Medium	High	High	Slow	High	Low
Voice mail	Low-Medium	Low	Few	Low-Medium	High	Slow	Medium	Low
Fax	Low-Medium	Low	Few-Medium	High	High	Slow	High	Low
Documents	Low	High		High	High	Slow	High	Low

It is important to understand that these propositions are made under the premise that all media capabilities are fully appreciated and used by the media user. Although users can choose how to use media, the capabilities provided by the media also restrain users' behaviour - that is, the "fit" between media capabilities and task requirement influences how individuals choose and use communication media (DeSanctis & Poole, 1994; Yoo & Alavi, 2001). Therefore, media users are more likely to select and use the media that they find is most appropriate for the task. Also, the selection and use of a particular media is influenced by the users' training and experience on the particular media, and their attitude towards the media (DeSanctis & Poole, 1994; King & Xia, 1997). Moreover, modern communication media may provide multiple capabilities (for example, a mobile phone can offer text, voice, and video communication functions on a single platform). In such a situation the level of synchronicity is not determined by the capabilities available, but rather by how the users use the media. In conclusion, when studying the effect of media capabilities on synchronicity, it is "necessary to examine the underlying media capabilities provided and used, rather than considering the device itself as a single entity"(Dennis et al., 2008, p. 588).

2.5.2.3 The effect of communication context

According to MST, communication performance is not only affected by the "fit" between media characteristics and the underlying communication process, but is also influenced by the context in which the communication occurs (Carlson & Zmud, 1999; Kock, 2004; Zack, 1994).

Based on the Time, Interaction and Performance Theory developed by Joseph McGrath in 1991, Dennis et al. (2008) propose that the accomplishment of a communication task requires individuals to work as a group. Such a group has two functions: the production function (activities that need to be accomplished), and the social function (relationships and the support of individuals). Within these two functions there are four modes of activity. The inception (understanding task goals

and developing a strategy), technical problem solving (the resolution of issues about how the task will be accomplished), conflict resolution (policy choice), and finally execution (goal attainment). While the inception mode and the execution mode are involved in all group activities, the conflict resolution mode and the technical problem solving mode may or may not be involved (McGrath, 1991). In the most straight forward situations, the group will move directly from inception to execution because this direct path is the most time and resource efficient. When there is a significant change on the task context (for example: new group members, change of task specifications), the group may move through each step, or when there is a power conflict within the group, the group may move from inception mode to conflict resolution mode before moving to execution mode (McGrath, 1991).

Based on TIP theory, Dennis et al. (2008) suggest that the amount of convergence and conveyance required in the different modes varies according to the task context. When group members are familiar with each other, the task, and the media, they will develop shared mental models including rules, routines, and mutual understandings very quickly. These shared mental models reduce the amount of convergence of meanings between group members required in the inception and execution modes. Even when the group moves to technical problem solving or conflict solving modes due to unexpected events, less convergence will be needed because these modes often involve the development of mutual understanding. When group members are not familiar with each other, the task and the media, shared mental models will more difficult to develop. Conveyance and convergence are both involved but convergence will play a more important role because negotiation on values, interests, power, and strategy choice will need to take place in each of the group modes (Dennis et al., 2008).

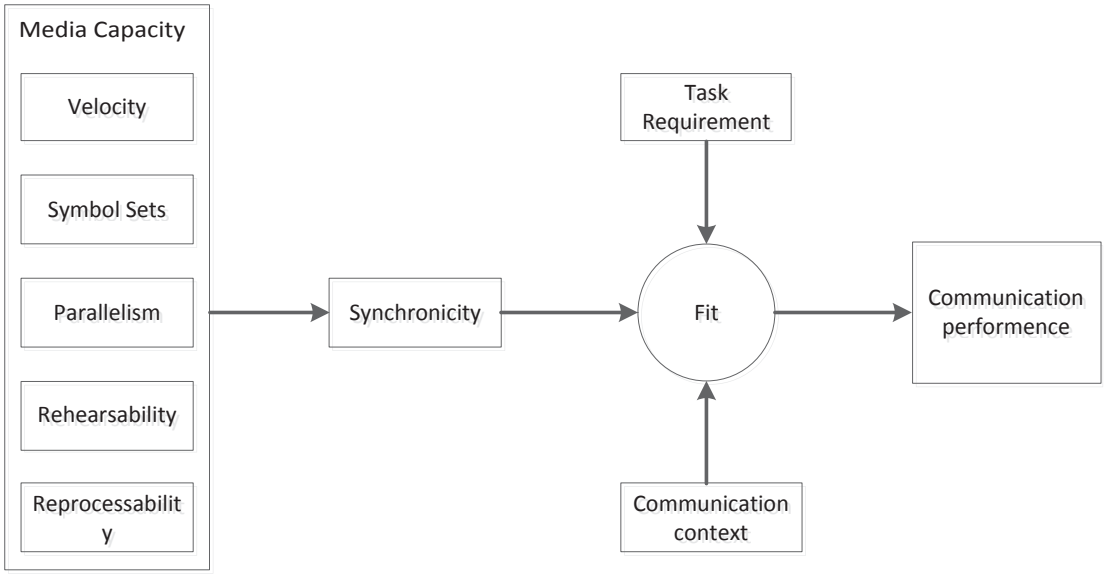

Figure 2.3. Communication media have different capabilities that supporting synchronicity. The "fit" between synchronicity, communication processes, and communication context determines communication performance. Adapted from: "Media, tasks, and communication processes: A theory of media synchronicity," by Dennis et al., 2008, *MIS quarterly*, 32(3), p. 582.

In conclusion, different degrees of conveyance and convergence processes are required when dealing with a task. Therefore individuals who are familiar with each other, the task and the media have less of a need to use media that supports synchronicity, whereas individuals who are unfamiliar with each other, the task or the media have a greater need to use media that supports synchronicity. Thus, communication performance improves when there is a fit between task requirements, the media capabilities, and the communication context (Dennis et al., 2008).

2.5.3 The effect of media use on tacit knowledge transfer

2.5.3.1 The application of MRT on tacit knowledge transfer

According to Nonaka and Konno (1998), joint activities are needed for tacit knowledge transfer between individuals. Therefore, person-to-person interaction is the key to promote tacit knowledge transfer (Hansen et al., 2000). Rich communication media such as video-conferencing allows people to provide immediate feedback and transmit a variety of communication cues to each other,

which allows people to “co-presence” without “co-location” (Boisot, 1998), therefore enabling tacit knowledge transfer between people in different locations.

Because tacit knowledge is personal and contextual, it is highly ambiguous and open to different interpretations and views (Joia & Lemos, 2010). The ambiguity of tacit knowledge creates “stickiness”, which hinders its transfer. MRT suggests that rich communication allows people to overcome ambiguity and helps them to process complex information (Daft & Lengel, 1986). Therefore the use of rich media facilitates tacit knowledge transfer.

In a survey of health care employees in 2007, it was concluded that people use richer communications media such as face-to-face and video conferencing to transfer tacit knowledge, and leaner media such as email and organisational database to transfer explicit knowledge (Murray & Peyrefitte, 2007). A number of studies concluded that the use of rich media leads to better tacit knowledge transfer (Casal & Fontela, 2007; Hasty et al., 2006; Joia & Lemos, 2010; Sheng, Chang, Teo, & Lin, 2013). The relationship between media richness and knowledge transfer was investigated in a number of studies. Pedersen, Petersen, and Sharma (2003) surveyed multinational companies in Denmark, and found that the performance of knowledge transfer was maximised when tacit knowledge was transferred through rich communication media and explicit knowledge transferred through lean communication media.

2.5.3.2 The application of MST on tacit knowledge transfer

While MST has been used to examine the effect of communication media on the efficiency of negotiations (Scheck, Allmendinger, & Hamann, 2008) and group performance (Rahman, Cheng, & Bayerl, 2013; Shim, Suh, & Im, 2010), few studies have investigated the application of MST to the transfer of knowledge, and even less on the transfer of tacit knowledge.

However, several studies explored the effects of media capabilities (as part of media synchronicity). Scott and Sarker (2010) found that symbol sets and reprocessability

positively affected knowledge receivers' ability to internalise knowledge. In their experiment, symbol sets were manipulated so that some participating groups used text only online tutorials and other groups used text and graphic online tutorials. Reprocessability occurred by enabling and disabling participants to revisit previous tutorials when they were working on a task. Because the task was drawing an activity diagram solely by following an online tutorial, the knowledge received by the participants can be considered as explicit knowledge. Therefore, in this situation low synchronicity (written and graphical messages, high reprocessability) between the knowledge source and knowledge recipient positively influenced the transfer of explicit knowledge.

Arguing that remote site health care delivery involves tacit knowledge transfer, Paul (2005) found that a telemedicine system capable of delivering synchronous communication, (voice and video messages) significantly improved the performance of remote site health care delivery. Jasimuddin (2007), who studied knowledge transfer mechanisms in UK based high tech groups, found that while the information technology infrastructure was capable of managing explicit knowledge efficiently, the most effective way to transfer tacit knowledge was still face-to-face communication. The possibility of using virtual worlds as platforms of knowledge management was studied by Mueller, Hutter, Fueller, and Matzler (2011) . They found that individuals benefited from the functionalities of virtual worlds. The synchronous interaction, variety of communication channels, social presence, and so on, which allowed them to interact with each other in a shared context, facilitated the transfer of tacit knowledge (Mueller et al., 2011).

2.5.3.3 Prior measurements of tacit knowledge

Because the concept of "tacit knowledge" itself remains tacit, it is difficult to explain to the participants what exactly tacit knowledge is, and it is even more difficult to assess the degree of tacitness. There is no generic measurement for tacitness in the literature; all measurements are designed to fit the respective settings.

One popular measurement for tacitness is the Tacit Knowledge Inventory for Managers (TKIM) developed by Wagner and Sternberg (1991). This measurement is based on the idea that tacit knowledge is acquired through experience and influences the knowledge holders' performance in the working environment. The approach suggested by TKIM is to develop a series of questions simulating workplace-related problems through interviewing personnel in a related field or through direct observation, then ask the participants to respond as to how they would solve the problem by rating various options (Wagner & Sternberg, 1991). This approach is used to assess tacit knowledge possessed by military leaders for example (Hedlund et al., 2003). However, it may only indicate the quality of the decision rather than tacit knowledge (Goffin, Baxter, Szwejczewski, Cousens, & van der Hoven, 2010), and if it does measure tacit knowledge, it only measures the tacit knowledge the respondent already possesses, not the tacit knowledge they may have exchanged.

When related to performance, tacit knowledge has often been assessed using proxy measures. In a study of the effect of tacit knowledge on performance in the National Basketball Association in the USA, Berman, Down, and Hill (2002) argued that basketball players develop tacit knowledge though their actual playing. They suggested that tacit knowledge of a player can be measured by counting the total playing time. In another study involving cardiac surgical teams in 15 hospitals, tacit knowledge was measured by assessing the time spent operating?? In theatre?? and the outcome of a team when performing surgery (Edmondson, Winslow, Bohmer, & Pisano, 2003). However, this approach was criticised because of its lack of construct validity (Ryan & O'Connor, 2009).

Based on the characteristics of tacit knowledge, some studies measure tacitness according to the degree of codifiability and articulability. In Hansen's (1999) study based on R&D managers of a multinational and multidivisional electronics and computer firm in the USA, the tacitness of transferred knowledge is measured by the

degree of documentation and the degree of codification. A similar measurement is used by other studies (Cavusgil et al., 2003; Levin & Cross, 2004; Minbaeva, 2007; Zander & Kogut, 1995).

Gupta and Govindarajan (2000) measured tacit knowledge by focusing on specific types of knowledge where both experience and values were involved, and which were context specific. To investigate the knowledge flow between subsidiaries of multinational corporations, Gupta and Govindarajan distinguished "procedural knowledge" (know-how such as design and distribution knowledge) from "declarative knowledge" (operational information such as financial data). The study focused on the procedural knowledge regarding marketing, distribution, packaging, design, and purchasing, and the measurement items were designed to fit the specific research setting.

2.5.3.4 Prior measurements of media synchronicity

A large number of empirical studies testing MST are experimental. In many of these experiments, researchers provide one group of participants with media that support high synchronicity (e.g., face-to-face), and the other group with media that support low synchronicity (e.g., text based instant messaging software) (DeLuca & Valacich, 2006; Dennis et al., 1998; Hasty et al., 2006; Lober, Schwabe, & Grimm, 2007; Murthy & Kerr, 2003; Schmidt, Montoya‐Weiss, & Massey, 2001). Others have enabled or disabled the functions of a given communication media. For example, turning on and off the audio chat function in a virtual communication tool corresponds to high and low synchronicity (Gressgård, 2012; Münzer & Holmer, 2009; Rahman et al., 2013; Scheck et al., 2008; Scott & Sarker, 2010; Shim et al., 2010).

The media capacity comparison table provided by Dennis et al. (2008) has also been used as a direct measurement for synchronicity (e.g. face-to-face > video conference > telephone > email). In these studies, participants are asked to indicate their choice of communication media in a particular communication (Kock & Lynn, 2012; Ryoo & Koo, 2010).

2.6 Interactive effect of media choice and relationship strength

The interaction between relationship strength and media use in various fields has also been explored. Carlson and Zmud's (1999) Channel Expansion Theory looked into whether individuals' familiarity with each other changed their perception of the richness of used communication media. They found that participants believed the communication media they used was richer when they were familiar with their communication partners. They suggest that communication partners gain knowledge-building experiences with each other through the development of strong relationships, which allowed them to encode and decode each other's messages more quickly, and include richer meaning in the messages (Carlson & Zmud, 1999). Fernandez, Simo, Sallan, and Enache (2013) had similar conclusions.

Based on MRT and Time, Interaction, and Performance theory, Hollingshead, McGrath, and O'Connor (1993) explored how relationship strength and media use affected task performance. Again through experiment, they found that people who used face-to-face communication performed better than people who used computer mediated communication on intellectual and negotiation tasks. However, when people had built up relationships over a period of time, their performances were equal regardless of the media use. Similarly, Fuller and Dennis (2009) found that task-technology fit (e.g., the use of synchronous communication for discussion and the use of asynchronous communication for information processing) led to better task performance, however the importance of the fit lowered over time. Maruping and Agarwal (2004) argue that the use of media that support high synchronicity leads to better conflict management performance in the early stages of a project, and the use of media that support low synchronicity leads to better conflict management performance in the later stages.

Some of the above studies influenced the development of, and provided support to MST. Overall researchers suggest that people develop relationships over time

through common experience and interaction, this helps with the development of common understanding or what Kock (2004) called “mental schema” (Carlson & Zmud, 1999; Maruping & Agarwal, 2004). Such mental schema between people influences their media use as well as the communication performance.

2.7 Summary

This chapter discussed the conceptualisation of knowledge and tacit knowledge. Due to its nature, individuals need to rely on their tacit knowledge to interpret and implement a policy. There are many factors that influence tacit knowledge transfer, and this study focuses on personal relationships and communication media, as well as the interaction between these two factors.

Applying MRT, knowledge transfer activity is considered as a task, the equivocality of the task depending on the tacitness of the knowledge. Therefore lean media leads to better explicit knowledge transfer and rich media facilitates tacit knowledge transfer. However it is argued that the reason empirical studies of MRT had inconsistent results is because of its focus on the role of the task, and neglects the influence of social factors.

MST emphasises the importance of the communication processes required by the task, and how media capabilities support such processes. It suggests that social factors, such as the communication context and users’ experience, significantly influence the communication processes as well as the outcomes of the communication tasks.

Even though the level of synchronicity and the relationship between individuals have both been demonstrated to affect tacit knowledge transfer success, the interaction between them has not been tested in a single model in this field. In particular, the relationship factors may affect tacit knowledge transfer differently depending on the choice of media between individuals.

CHAPTER 3. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

3.1 Introduction

This chapter starts by discussing the theoretical foundations for the research, then the initial research model and the revised research model are presented, and hypotheses are introduced and justified.

3.2 Conceptual foundation

This study drew from two theoretical perspectives: the theories of Tacit Knowledge Transfer, and Media Synchronicity Theory. Although knowledge transfer can be studied on both organisational and individual levels, this study focuses on tacit knowledge transfer activities at an individual level.

3.3 Research model

This study conceptualises the construct of tacit knowledge transfer success based on Argote and Ingram (2000), which is the change of the knowledge recipient's performance or the change of the recipient's knowledge base induced by the tacit knowledge transfer. It focuses on the effects of the relationship strength between individuals and the type of communication media that is used.

Even though the relationship between individuals and the use of communication media have both been demonstrated to affect the success of tacit knowledge transfer, the interaction between them has not been tested in a single model. In particular, the type of relationship may affect tacit knowledge transfer differently depending on the choice of communication media between individuals.

The research model of this study is presented in Figure 3.1.

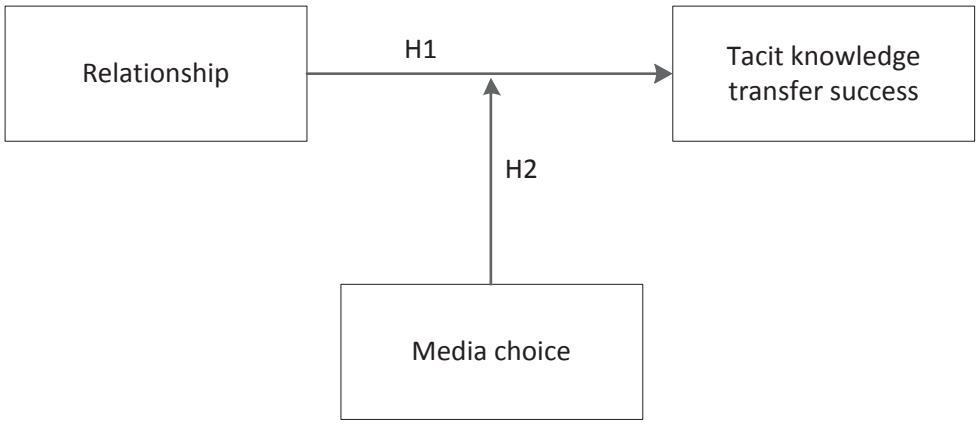

Figure 3.1. The initial research model

3.4 Factors hypothesised to affect tacit knowledge transfer success

3.4.1 Relationship

Individuals develop relationships through their interactions with each other. A review of previous studies suggests that a strong relationship consists of frequent interaction and communication, common experience, and a high level of trust, helps overcome difficulties in tacit knowledge transfer processes.

It is suggested that when two individuals have a close personal relationship, they are more motived to help the other (Brann & Foddy, 1987; Organ, 1990), therefore individuals are more willing to share their tacit knowledge without fear of losing knowledge power. Nonaka and his colleagues found that a close personal relationship combined with frequent interaction in an organisational context often led to the transfer of tacit knowledge (Nonaka & Konno, 1998; Nonaka & Takeuchi, 1995). As a result of having a close relationship, trust between individuals is both a prerequisite and the facilitator of tacit knowledge transfer.

Therefore hypothesis 1 of this study is stated as following:

H1: A close relationship between individuals leads to better tacit knowledge transfer success

3.4.2 Interacting role of media use

Although a personal relationship between individuals affects tacit knowledge transfer, the strength of such an effect is influenced by an individual's choice of communication media.

Researchers agree that the transfer of tacit knowledge through asynchronous media is difficult because of the nature of tacit knowledge, which is context specific, personal, and hard to express (Jasimuddin, 2007; Joia & Lemos, 2010; Murray & Peyrefitte, 2007). Through asynchronous media, messages are delivered mainly in the form of writing or graphs. These types of communication cues are considered to be of a low degree of naturalness, and need more cognitive effort to be interpreted than languages of a high degree of naturalness (e.g., body language). Where the relationship is distant, messages delivered through asynchronous media require more cognitive effort to be interpreted, and the contextual information contained in the message is not likely to be noticed or understood, which makes the transfer of tacit knowledge difficult.

However, these cognitive efforts can be reduced by communication partners having a common understanding or shared mental framework between them that is established through frequent interaction with each other (Kock, 2004). Also, when communication partners have experience with each other, even "lean media" can be perceived as "rich" because of the established common understanding between them (Carlson & Zmud, 1999). Consistently, in MST, Dennis et al. (2008) suggest that when communication partners are familiar with each other, the accomplishment of a communication task requires less convergence of meaning and greater conveyance of information. Therefore, a close personal relationship enables individuals to communicate efficiently and facilitates tacit knowledge transfer between them. In summary, the strength of the personal relationship between individuals has a significant effect on the success of tacit knowledge transfer when using asynchronous media.

When using synchronous media, messages are delivered through multiple cues, combined with a high degree of naturalness, which require less cognitive effort to be interpreted. Synchronous media have a greater capacity to support the conveyance of meanings, which allows individuals to build shared mental models very quickly even when they are not familiar with each other. Therefore, regardless of the state of the personal relationship, individuals are able to interpret the message delivered through synchronous media very quickly. Even when a common understanding is needed to achieve successful tacit knowledge transfer, it can be established quickly through the convergence of meaning supported by synchronous media. Therefore, the strength of personal relationships between individuals has a weaker effect on the success of tacit knowledge transfer when using synchronous media.

Therefore, hypothesis 2 of this study is stated as following:

H2: The effect of the relationship between individuals on tacit knowledge transfer success is stronger when people use asynchronous media than when people use synchronous media.

3.5 Refined model

However, as discussed in section 2.4.5, relationship strength is multidimensional. By doing exploratory factor analysis, as well as carefully comparing to prior studies, it was confirmed that the construct could be brocken into two components, namely closeness and trust.

Both closeness and trust are aspects of personal relationship, and both positively influence tacit knowledge transfer (see discussion in section 2.4.4). Therefore, based on the result of construct separation, the hypotheses were restated.

Hypothesis 1, "*A strong relationship between individuals leads to better tacit knowledge transfer success*" was restated as:

> H1a: *A Higher level of closeness between individuals leads to better tacit knowledge transfer success.*

H1b: *A Higher level of trust between individuals leads to tacit knowledge transfer success.*

Group comparison method was used to test moderation effect (discussed in detail in section 4.4.4). Based on the result of group separation, which is presented in section 5.5, only two groups were included in the model testing: Group 1 participants used only synchronous media, and Group 2 participants used both synchronous and asynchronous media.

Hypothesis 2, "*The effect of the relationship between individuals on tacit knowledge transfer success is stronger when people use asynchronous media than when people use synchronous media*" was restated as:

H2a: *The effect of the closeness between individuals on tacit knowledge transfer success is stronger when people use both synchronous media and asynchronous media than when people use only synchronous media*.

H2b: *The effect of trust between individuals on tacit knowledge transfer success is stronger when people use both synchronous media and asynchronous media than when people use only synchronous media.*

The revised model is presented in figure 3.2.

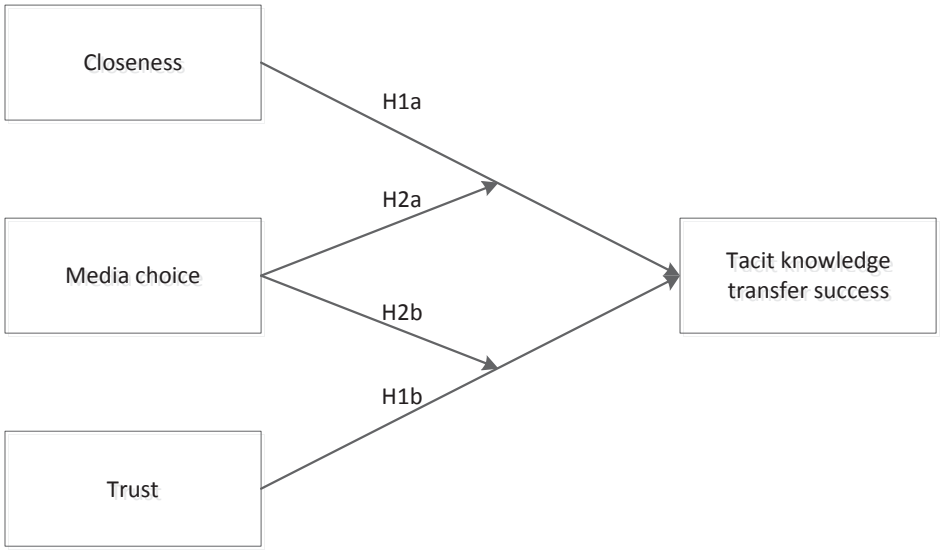

Figure 3.2. The revised research model

3.6 Summary

Based on the gap identified in the literature review, this chapter presents the conceptual foundation, the research model, and hypotheses of this study. The research model highlights the interaction between the personal relationship and media choice. The model suggests that the strength of the effect of personal relationships on tacit knowledge transfer success is influenced by the individual's media choice. EFA result presented in section 5.6 demonstrated that construct Relationship Strength was multidimensional, and was separated into two constructs: closeness and trust. Hypotheses were therefore restated.

CHAPTER 4. RESEARCH METHOD

4.1 Introduction

This chapter starts by discussing the research method employed in this study, including a discussion of positivist and interpretive approaches, a comparison between quantitative, qualitative, and mixed research methods, as well as the reasons behind the selection of the research method to address the research problem. A mixed research method is employed in this study, which includes a survey and several semi-structured interviews. The procedures leading to quantitative and qualitative data collection are discussed. This is followed by a description of the ethical considerations, as well as approaches to both quantitative and qualitative data analysis.

4.2 Overall research approach

4.2.1 Positivism and Interpretivism

Positivism and interpretivism are the two most dominant research paradigms in social science (Sarantakos, 1993). Positivists assume that reality is objective, the research observations are free of influence from the researcher, and the research emphasises facts and predictions. Therefore the result is generalizable. In contrast, interpretivists assume that reality is subjective, is defined by people and is focused on human sense-making. The research result is based on the interpretation of social reality and the understanding of meanings. Therefore the result may change when the research context changes (Cox & Hassard, 2005; Sarantakos, 1993).

Quantitative and qualitative methodologies are built upon these two dominant paradigms. While the former is based on positivism; the latter is based on interpretivism. Quantitative research is focussed on theory and hypothesis testing using statistical analysis of standardised data, which allows the research to be

replicated to another population, and the research result to be generalised. Qualitative research is focussed on answering research questions using interpretation and exploration of rich data (Johnson & Onwuegbuzie, 2004).

4.2.2 Mixed research method

Because quantitative and qualitative methods each have their respective strengths and weaknesses (See table 4.1), a mixed research method is likely to provide stronger results by the combination of both quantitative and qualitative data in the one study (Johnson & Onwuegbuzie, 2004).

Table 4.1

A comparison of the strengths and weaknesses of quantitative and qualitative research methods

Quantitative Research Method	Qualitative Research Method
Strengths:	**Strengths**:
Testing and validating already constructed theories about how (why) phenomena occur.	It is useful to describe complex phenomena.
Testing hypotheses that are constructed before data are collected.	It is useful to study a limited number of cases in depth.
Research findings are generalizable when the data are based on random samples	Can conduct cross-case comparison and analysis.
Research findings are replicable.	The researcher identifies contextual and setting factors as they relate to the phenomena of interest.
Allow quantitative predictions to be made.	It is based on the participants' own perception of the constructs.
Researchers may eliminate the confounding influence of many variables.	Provides understanding and description of participants' personal experience of the phenomena.
Data collection is quick and time efficient and it provides precise, numerical data.	Responsive to local situations, conditions, and stakeholders' needs.
The research results are relatively independent of the researcher.	Responsive to change that occurs during the conduct of a study.
Weaknesses:	**Weaknesses**:
The researcher's categories and theories that are used may not reflect local constituencies' understanding.	Knowledge generated may not generalize to other people or other settings.
The researcher may miss out on phenomena occurring because of the focus on the theory or hypotheses generation (the confirmatory bias).	It is difficult to make quantitative predictions, to test theories and hypotheses.
Knowledge generated may be too abstract and general for direct application to specific local situations, contexts, and individuals.	It takes more time and effort to collect and analyse data
	The result is easily influenced by the researcher's personal bias and idiosyncrasies.

Note. Adapted from "Mixed methods research: A research paradigm whose time has come," by R. B. Johnson and A. J. Onwuegbuzie, 2004, Educational researcher, 33(7), 14-26.

Mixed method research collects, analyses, and integrates both quantitative and qualitative data in the one study. In a mixed method research, both quantitative and qualitative methods can retain their structures and procedures, or these methods can be adapted, altered or synchronised to fit the research situation (Creswell & Clark, 2007; Sandelowski, 2003). Although the mixed method approach has been criticised because it integrates two different underlying epistemological assumptions (Creswell, 2013), it has been widely and successfully used by researchers (Mingers, 2001). Table 4.2 shows the strengths and weaknesses of mixed methods research.

Table 4.2

Strengths and weaknesses of mixed research method

Strengths:	**Weaknesses:**
Words, pictures, and narratives can be used to add meanings to numbers.	Can be difficult for a single researcher to carry out both qualitative and quantitative research.
Numbers can be used to add precision to words, pictures, and narratives.	Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.
Can provide quantitative and qualitative strengths.	Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm.
Researchers can use the strengths of an additional research method to overcome the weakness in another method by using both in a research study.	More expensive and time consuming.
Can answer a broader and more complete range of research questions.	Some of the details or mixed research remains to be worked out fully by research methodologists (e.g. problems of paradigm mixing, how to qualitatively analyse quantitative data, how to interpret conflicting results).
Can provide stronger conclusion through convergence and corroboration of findings.	
Can produce more complete knowledge necessary to inform theory and practice.	

Note. Adapted from "Mixed methods research: A research paradigm whose time has come," by R. B. Johnson and A. J. Onwuegbuzie, 2004 , Educational researcher, 33(7), 14-26.

There are three main types of mixed method research design (Creswell & Clark, 2007). The convergent parallel method (QUAL,QUAN) where both qualitative and quantitative methods complement each other and are used equally; the exploratory

sequential method (QUAL-quan) where exploratory qualitative research is expanded by doing follow-up quantitative research; and the explanatory sequential method (QUAN-qual) where a better understanding of the results of quantitative research is gained with in-depth analysis of detailed data.

4.2.3 Overview of research method

A number of studies focusing on communication media have taken a quantitative approach, such as experiments (Andres, 2013; Dennis et al., 1998; Fuller & Dennis, 2009; Hollingshead et al., 1993), surveys (Carlson & Zmud, 1999; Kock & Lynn, 2012; Murray & Peyrefitte, 2007), and a combination of both (Gressgård, 2012; Kahai & Cooper, 2003; Scott & Sarker, 2010). However other researchers state that a simple cause-effect relationship cannot explain the use and performance of communication media, and they tend to use qualitative research such as interviews (Jasimuddin, 2007; Paul, 2005) and observations (Liukkunen & Markkula, 2012) to investigate the mechanism of media use.

In this study, an explanatory sequential mixed method research design is used, which will test the research hypothesis using a questionnaire, followed by interpretation and analysis of interview data.

4.2.4 Overview of research procedures

The overall research procedures are presented in figure 4.1. The quantitative aspect was developed to answer questions discovered through a review of the literature, and the research hypotheses were tested by analysing quantitative data collected using online and mail out surveys. Semi-structured interviews were undertaken using questions that were based on the research questions and the survey answers. Details of the research procedures are elaborated in the following sections.

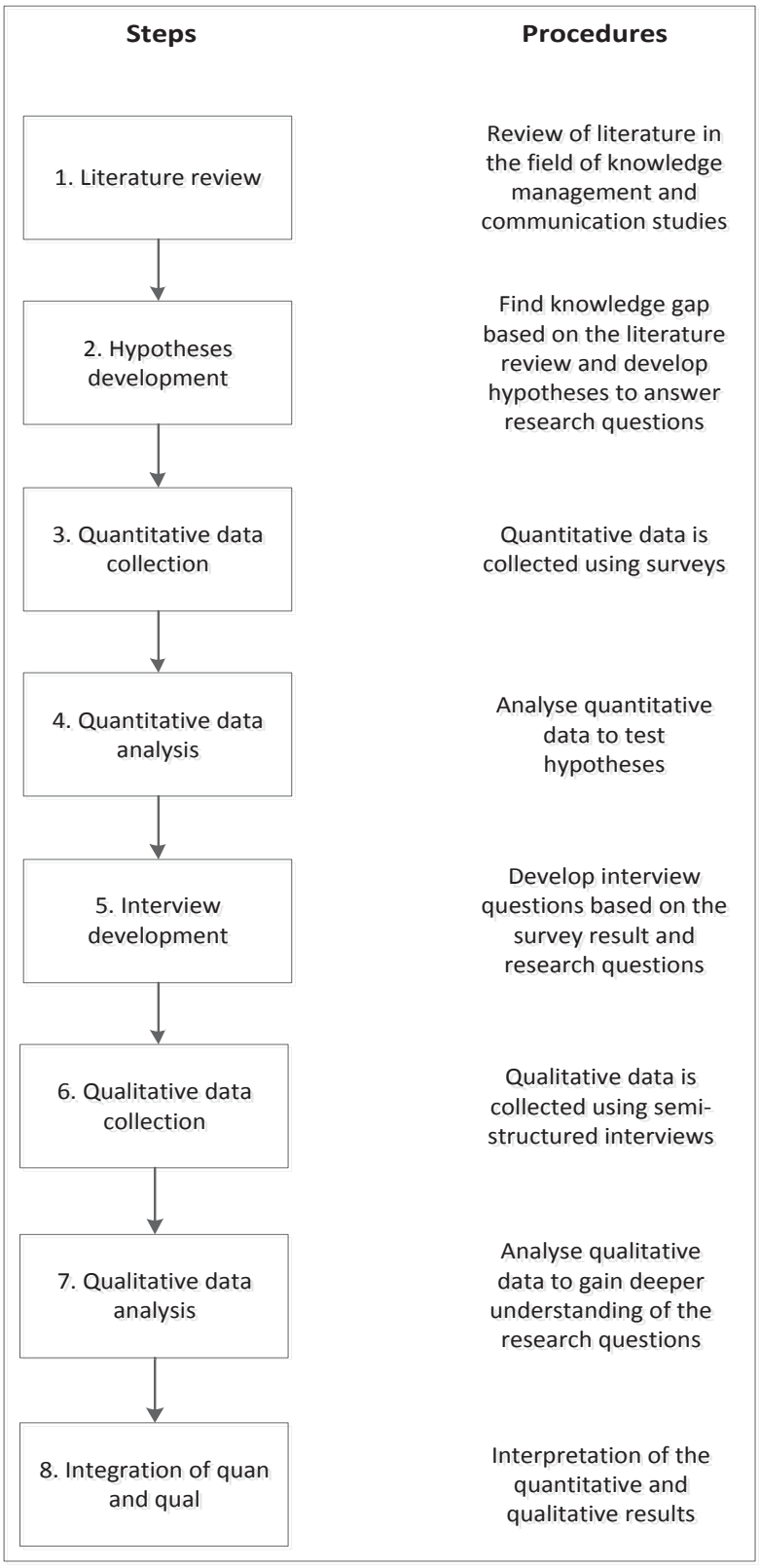

Figure 4.1. Overall research procedure

4.3 Quantitative data collection

The following sections present the procedures of quantitative data collection.

4.3.1 Procedures of quantitative data collection

The procedures leading to the quantitative data collection are presented in figure 4.2.

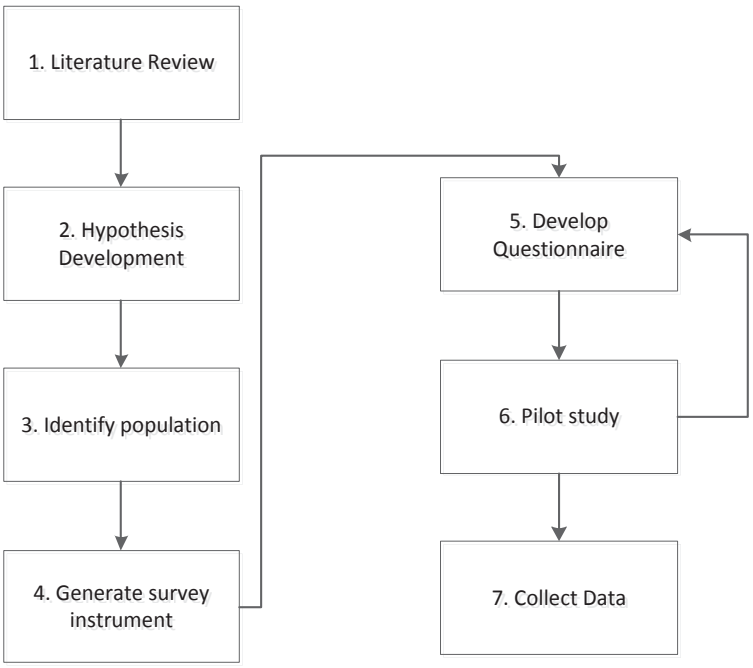

Figure 4.2. Procedures leading to quantitative data collection. Adapted from: "A paradigm for developing better measures of marketing constructs," by G. A. Churchill Jr., 1979, *Journal of marketing research*

4.3.2 Unit of analysis and population

The unit of analysis in this study is the discussion between individuals. The population was identified based on the following criteria:

1. Knowledge transfer activity in their work related activity

2. Use of a variety of communication media

3. Understanding of, and working within policies in their workplaces

Based on these criteria, the respondents are university teachers (university employees involved in teaching students) in New Zealand in the disciplines of human health and medicine. Participants were identified based on their information on university websites, such as their titles and job descriptions. Over all a total number of 1774 contacts were collected. Because Waikato University and Lincoln University do not have departments related to human health and medicine, the sample size contains teachers from six universities across New Zealand (see table 4.3).

Table 4.3

Number of potential participants in New Zealand universities

Institute	Number potential participants
Auckland University	587
Auckland University of Technology	173
Massey University	83
University of Canterbury	27
University of Otago	890
Victoria University of Wellington	14
Total	1774

4.3.3 Overview of research instrument

There were five sections in the questionnaire (See appendix A). The first section focused on the success of tacit knowledge transfer. The second and the third sections of the questionnaire focused on the participant's choice of media and how they used the media. The survey items in these two sections were the same but they were structured into two sections, one for synchronous communication media and the other for asynchronous media. The fourth section of the questionnaire focused on the level of familiarity between the participants and their colleague. The last

section of the questionnaire included questions focusing on demographic information and an invitation to participate in follow-up interviews.

An 11-point Likert scale was used in both the online and paper based surveys, because it minimises categorical effect (Hier & Walby, 2013) and it increases reliability and validity (Lozano, García-Cueto, & Muñiz, 2008). Some researchers argue that a five-point scale is not sensitive enough to capture people's perceptions (Chan & Chow, 2007), and others believe that the 11-point scale is more sensitive and can measure attitudes and perceptions more precisely (Hodge & Gillespie, 2007; Leung, 2011). 11-point Likert scales have been used in several studies in the field of information systems (Barki & Hartwick, 2001; Kettinger, Park, & Smith, 2009).

4.3.4 Operationalization of Variables

Most of the survey items were adapted from previous studies. Therefore, the operationalization of constructs used in this study was based on measurements from prior studies with known properties. The remaining items were formulated based on the definitions of the constructs taken from the relevant literature. All survey items were carefully worded to make sense to members of the target population.

4.3.4.1 Media choice

To measure media choice, a list of available communication media was generated, which included synchronous communication (such as formal and informal face-to-face communication, video conferencing and telephone) and asynchronous communication (such as email, instant messaging and voice mail).These have been examined in previous studies (Kock & Lynn, 2012; Ryoo & Koo, 2010), but this study includes new media such as blogs and social media sites which have rarely been addressed (see table 4.4).

Table 4.4

Items measuring Communication Media Chioce

Items	Source
We discussed face to face during chance encounters	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed face to face at formal meetings	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed using video-conferencing (e.g., Skype)	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed over the phone	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed using e-mail	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed using instant text messaging (e.g., TXT on a mobile phone, MSN messenger, or similar)	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed by posting blog posts	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed over a discussion forum	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed by posting on social media sites (Facebook, LinkedIn, or similar)	Ryoo & Koo (2010); Dennis et al. (2008)
We discussed by leaving voice mail messages	Ryoo & Koo (2010); Dennis et al. (2008)

4.3.4.2 Relationship strength

To measure the relationship strength between communication partners, items from Carlson and Zmud (1999) and McKnight et al. (2002) were adapted. These items relate to how close the participant is with the communication partner, how comfortable the participant is with using informal language, whether the participant is willing to share personal or private problems with the communication partner, participants' perception of the communication partners' benevolence and integrity, as well as the participants' willingness to depend on the communication partner when a problem arises (see table 4.5).

Table 4.5

Items measuring Relationship Strength

Items	Source
I feel comfortable using informal language with the colleague	Carlson & Zmud (1999)
I feel comfortable discussing personal issues with the colleague	Carlson & Zmud (1999)
I feel comfortable discussing private issues with the colleague	Carlson & Zmud (1999)
I feel comfortable communicating with the colleague	Carlson & Zmud (1999)
I feel close to the colleague	Carlson & Zmud (1999)
I feel I know the colleague well	Carlson & Zmud (1999)
If I required help, the colleague would help me	McKnight et al. (2002)
The colleague knows my organisation's policies very well	McKnight et al. (2002)
The colleague has good judgement in interpreting my organisation's policies	McKnight et al. (2002)
I can always rely on the colleague for help with problems around my organisation's policies	McKnight et al. (2002)

4.3.4.3 Tacit knowledge transfer success

This study focuses on a specific type of tacit knowledge, which is the knowledge of interpretation and implementation of organisational policies (see discussion in section 2.5.3.3). The type of knowledge to focus on was chosen to allow a clear distinction between tacit and explicit knowledge, and to ensure that it was relevant and of interest to the population (so that the respondents could answer the survey questions and were motivated to answer the survey questions).

To measure tacit knowledge transfer success, items from Ko, Kirsch, and King (2005) were adapted. Based on Argote and Ingrams (2000) conceptualisation of knowledge transfer success, these items assess the knowledge receivers' conception of their improvement of work performance or change of knowledge base after the knowledge transfer activity. The same measurement is used by Scott (2008) and

Joshi (2007), and has demonstrated high reliability and validity. In addition, measurements from Szulanski (1996) were also adapted to access participants perception on the time and effort spent during the knowledge transfer process in this study.

Overall, in this study, tacit knowledge transfer success is measured by assessing participants' improvement in their ability to interpret and act on organisational policy, which is induced by the discussion between the participants and their colleagues, as well as the time and effort spent on the knowledge transfer activity (see table 4.6).

Table 4.6

Items measuring tacit knowledge transfer success

Items	Source
The discussion improved my understanding of the meaning of the policy	Ko et al. (2005)
The discussion improved my understanding of the intent of the policy	Ko et al. (2005)
The discussion increased my knowledge of the content of the documents describing the policy	Ko et al. (2005)
The discussion improved my ability to access the documents describing the policy	Ko et al. (2005)
The discussion increased my understanding of how the policy relates to other policies at my organisation	Ko et al. (2005)
The discussion increased my ability to ask penetrating questions about the policy	Ko et al. (2005)
The discussion increased my ability to create my own documentation based on the policy (such as study guides, marking schedules, job descriptions etc.)	Ko et al. (2005)
The discussion improved my ability to take the policy into account when making decisions	Ko et al. (2005)
The discussion improved my ability to make suggestions regarding policy development at my organisation	Ko et al. (2005)
I learned from the discussion more than I initially expected	Szulanski (1996)
The discussion took more effort than I initially expected	Szulanski (1996)
The discussion took more time than I initially expected	Szulanski (1996)

4.3.4.4 Communication pattern

To gain a greater depth of understanding about how people use communications media, additional items were included to gain information about the communication pattern during the discussion. Items from Sarker et al. (2010) and Fernandez et al. (2013) were adapted to measure velocity, which is the participants' perception of speed of feedback received and provided during the discussion. To measure the naturalness of the language delivered through the media, items were developed based on MST (Dennis et al., 2008) and Kock (2004); participants were asked whether they relied on body language and voice intonations to express feelings when they were using synchronous media, or how much they relied on emoticons in text messages to convey feelings when they were using asynchronous media. Questions from Scott's (2008) survey were adapted to ask participants how much effort they spent on editing the message. Although these variables were not included in the model testing, the information elicited was used to gain deeper understanding of peoples' communication patterns as well as to develop interview questions (see tables 4.7 and 4.8).

Table 4.7

Items measuring the pattern of synchronous media use

Items	Source
Velocity	
I provided immediate feedback to the colleague	Sarker et al. (2010); Fernandez et al. (2013)
The colleague provided immediate feedback to me	Sarker et al. (2010); Fernandez et al. (2013)
The discussion proceeded very quickly	Sarker et al. (2010); Fernandez et al. (2013)
Language naturalness	
I used gestures to express my attitude to policy related issues	Dennis et al. (2008); Kock (2004)
I used voice intonation to express my attitude to policy related issues	Dennis et al. (2008); Kock (2004)
I relied on body posture to express my attitude to policy related issues	Dennis et al. (2008); Kock (2004)
I used facial expressions to express my attitude to policy related issues	Dennis et al. (2008); Kock (2004)
My colleague used gestures to express attitude to policy related issues	Dennis et al. (2008); Kock (2004)
My colleague used voice intonation to express attitude to policy related issues	Dennis et al. (2008); Kock (2004)
My colleague relied on body posture to express attitude to policy related issues	Dennis et al. (2008); Kock (2004)
My colleague used facial expressions to express attitude to policy related issues	Dennis et al. (2008); Kock (2004)
Rehearsability	
I carefully planned my verbal statements in advance	Scott (2008)
Reprocessability	
I frequently interrupted the discussion to look up saved messages relevant to the discussion	Scott (2008)
My colleague frequently interrupted the discussion to look up saved messages relevant to the discussion	Scott (2008)

Table 4.8

Items measuring the pattern of asynchronous media use

Items	Source
Velocity	
I provided immediate feedback to the colleague	Sarker et al. (2010); Fernandez et al. (2013)
The colleague provided immediate feedback to me	Sarker et al. (2010); Fernandez et al. (2013)
The exchange of messages proceeded very quickly	Sarker et al. (2010); Fernandez et al. (2013)
Language naturalness	
the colleague relied on emoticons to express attitude to policy related issues	Dennis et al. (2008); Kock (2004)
I relied on emoticons to express attitude to policy related issues	Dennis et al. (2008); Kock (2004)
the colleague relied on text appearance to convey information	Dennis et al. (2008); Kock (2004)
I relied on text appearance to convey information	Dennis et al. (2008); Kock (2004)
Rehearsability	
I spent a lot of time to edit messages before sending them	Scott (2008)
I formulated my messages with a lot of care (edit messages multiple times before sending)	Scott (2008)
Reprocessability	*Reprocessability*
I spent a lot of time examining saved messages	Scott (2008)

4.3.5 Tests for readability

The questionnaire was tested for readability twice before it was sent to participants. First with PhD students regarding readability and the presentation of both the online and mail out questionnaires. It was then presented to several lecturers to ascertain whether the questions made sense and the meanings were clear. Minor corrections and adjustments were made after each test.

4.3.6 Survey description

The survey was carried out between 17th November 2013 and 28th February 2014. It was distributed in two phases. In the first phase, 200 respondents from the sample size of 1774 were randomly selected. A survey package was sent to each of them using the Qualtrics online survey tool , this included an invitation email, a covering letter explaining the purpose of the study, the information sheet describing the details of this study and the research ethics, and a unique link directing them to the online questionnaire.

With no problems reported from the first phase of the survey, the second phase was carried out on 7th December 2013. The survey package contained the same items and were distributed to the rest of the participants using Qualtrics. The first email reminder (see appendix D) was sent out to those who had not responded to the survey on 18th December 2013. The second paper based reminder (see appendix D) was posted out on 10th January 2014, which contained a covering letter, the information sheet, the paper based questionnaire, and a prepaid and preaddressed envelope.

4.4 Approach to quantitative data analysis

The following sections describe the procedures of the preparation and analysis of quantitative data. The software used was Excel 2010, SPSS version 21 and SmartPLS 2.0.

4.4.1 Data entry

Data from the online survey were downloaded from the Qualtrics platform. The data file was edited using Excel to remove irrelevant information such as IP addresses and time recordings. Data from the mail out survey were manually entered into the data file. The manual data entry was carefully compared against the questionnaire to avoid any entry errors. Because the mail out survey was sent out as the last reminder, data obtained were categorised at a later stage whereas data obtained from the online survey were categorised at an early stage for the purpose of testing non-response bias. Finally, negatively worded items were recoded with correct values.

4.4.2 Preliminary data analysis

Using SPSS software, normality, outliers, and missing values were checked following established procedures. Although normality is not required by the PLS SEM analysis approach, it has a negative impact on the statistic power (Chin & Dibbern, 2010). Following the procedures described in Pallant (2010), normality was assessed by running Kolmogov-Smirnov statistics on each of the variables, assessing skewness and kurtosis values, as well as by visual inspection of the shape of the distribution of the variables in the histograms.

Missing values were checked for randomness using Little's MCAR test (Little, 1988), which assesses whether the missing values depend on the variables in the dataset. Once the randomness of the missing values was confirmed, the missing values were then replaced using the Expectation-Maximisation method (EM method) because it could produce unbiased parameter estimates when data are missing completely at random (Musil, Warner, Yobas, & Jones, 2002).

The data were checked for non-response bias. Non-response bias occurs when the answers of respondents differs to the potential answers of those who did not answer the survey. To check for non-response bias, late responses were assumed similar to non-responses following suggestions from Kanuk and Berenson (1975), and were

compared with early responses for statistical significant differences using a Mann-Whitney U test.

To check whether the data set was representative of the population, demographic information of survey participants was compared against demographic information of all university teachers from a government report published in 2010 (Nana, Stokes, & Lynn, 2010). Because the demographic data specifically for university teachers in human health and medicine disciplines was not obtainable, demographic data for all New Zealand university teachers was used for comparison. Chi-square good of fitness was used to test if there was a significant difference between these two ratios

4.4.3 Checking for common method bias

Because the data in this study was collected from the same source (measure of predictor and criterion variables were provided by the same respondents) using the same method (quantitative data was collected through only one survey), common-method variances (CMV) are likely to occur (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). CMV is the "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff et al., 2003) Common-method bias arises when participants try to maintain consistency between their answers to the questions addressing different variables (Podsakoff et al., 2003); when respondents try to gain social approval and present themselves in a favourable light, regardless of their true behaviour and feelings (Crowne & Marlowe, 1964); and when participants provide more positive scores to someone they know well and like than to someone they dislike (Podsakoff et al., 2003).

There are a number of remedies to reduce common method bias (Podsakoff et al., 2003; Tourangeau, Rips, & Rasinski, 2000). Researchers suggest that it would be effective to order the questions randomly when preparing the questionnaire. However this could result in a questionnaire that is difficult to read, causing participants to abandon the questionnaire. Another approach to reduce common

method bias is to obtain measures of the predictor and criterion variables from different sources, or from the same source but using a different method. However, this could significantly increase the cost and effort of the survey.

In this study, common-method bias was checked using Harman's single factor test. The basic assumption is that if common method bias occurs, a single factor emerges in the covariance among all variables (Podsakoff et al., 2003). The absence of a single common factor suggesting common method bias was not a problem. Although researchers argue that Harman's single factor test is insensitive, using it as the only statistical remedies to detect CMV is risky (Podsakoff et al., 2003; Richardson, Simmering, & Sturman, 2009), it is still the most frequently used method to check common-method bias (Craighead, Ketchen, Dunn, & Hult, 2011). Also, because this study employs mixed research method, qualitative information could complement survey results, therefore further verifying the absence of common-method bias.

4.4.4 Model refinement

Factor analysis was used to check the multidimensionality of one of the constructs. In order to compare groups, the data set was separated into three groups according to the participants' use of media.

4.4.4.1 Checking for construct multidimensionality

Factor analysis was used to check common-method bias, as well as the multi-dimensionality of one of the constructs in the study. Without any theoretical assumptions, exploratory factor analysis (EFA) suggests the latent variables explaining variability in a set of indicators. Because EFA take into account only the indicator loadings, it is important to examine the meaning of the indicators. The result of the EFA analysis is only acceptable when it is consistent with theory.

4.4.4.2 Separate groups for comparison

To test the moderation effect of media choice, a group comparison method was used. Henseler and Fassott (2010) suggest that when the moderation variable is categorical (in this study, the media choice would be synchronous, asynchronous, or

a mix), it can be used as a grouping variable to separate the data into different datasets. The model is applied to each of the datasets, and then the calculated parameter estimates can be compared for differences to test the moderation effect.

Following this method, the data was split into three groups based on participants' choice of media to compare whether there were significant differences between the path coefficients of these groups. In group 1, only synchronous media were used, in group 2, only asynchronous media were used, in group 3, a mix of synchronous and asynchronous media were used. Then all data files were loaded into SmartPLS and model testing was run on each dataset to obtain the path coefficient values and standard errors.

4.4.5 Approach to model testing

The research model was tested using the Partial least Square (PLS) Structural Equation Modelling (SEM) technique (using SmartPLS 2.0 software). PLS SEM was chosen because it did not require normal distributions, it could work with a small sample size, and it could test the moderation effect more effectively (Chin, 1998).

4.4.5.1 Construct validity

Construct validity refers to which indicators intended to measure a construct do accurately measure that particular construct (Hair, 2009). Construct validity can be confirmed by assessing content validity, convergent validity, and discriminant validity. All tests were carried out using SmartPLS 2.0 software.

Content validity refers to the extent to which a measure represents a construct correctly and fully covering the content of the construct (Hair, 2009). To ensure content validity, all items were adapted from prior researches (see discussion in section 4.3.4).

Convergent validity refers to the extent to which the indicators measuring the same construct correlate (Hair, 2009). Convergent validity can be measured by obtaining item reliability, internal consistency reliability, and the values of average variance

extracted (AVE). Item reliability is the standardised loading of an item on its construct. Following Chin's (1998) suggestion, a threshold value of .60 was used. Internal consistency reliability refers to the degree to which all items measuring the same construct produce similar results. It can be assessed using composite reliability or Cronbach's alpha (Hair, 2009). In this study, both composite reliability and Cronbach's alpha were employed, and following Chin (1998), a threshold value of .70 was used. AVE is the average variance shared between a construct and its measures, and following Fornell and Larcker (1981), a threshold of .50 was used.

Discriminant validity refers to the extent to which the items measuring different constructs uncorrelated to each other (Gefen & Straub, 2005). At item level, all items should load on their own constructs higher than on other constructs in the model, at construct level, the square root of AVE of each construct should be higher than the correlations of the construct to other constructs (Fornell & Larcker, 1981).

4.4.5.2 Approach to test model fit

The main model was tested following established procedure (Chin, Marcolin, & Newsted, 2003; Henseler & Fassott, 2010). Firstly convergent and discriminant validity were checked for all constructs, and items with low reliability and cross-loading items were deleted. Then the main effects were tested using the PLS algorithm and bootstrapping procedures to assess the statistical significance of path coefficients. Following Chin (1998), 500 resamples were used in the bootstrapping procedure.

The model fit was assessed by the statistical significance of path coefficients and by the amount of variance explained in dependent variables. Chin (1998) suggests that the path coefficient value should be above .20 to be meaningful. In terms of effect size, Kline (2011) suggests that a path coefficient value close or below .10 should be considered as small, a value close to .30 should be considered as medium, and a value close or greater than .50 should be considered as large. In terms of the amount of variance explained in dependent variable, Chin suggests that a R^2 value close

to .19 should be interpreted as weak, a value close to .33 should be considered as average, and a value close to .67 should be considered as substantial.

4.4.5.3 Approach to compare groups

Chin (2003) suggests that groups can only be compared for differences when there are good model fits, data is not too non-normal, and when there is measurement invariance between models.

Measurement invariance was tested following the technique developed by PLS expert Professor Diogenes Bido (2007) based on the work of Maruyama (1997). The technique is shown below and was posted on SmartPLS forum.

$$t = \frac{Loading_1 - Loading_2}{\sqrt{{S_1}^2 + {S_2}^2}}$$

Respectively, $Loading_1$ and $Loading_2$ are the loadings of each item, S1 and S2 are the standard errors for the first and the second Group. Obtained *t* statistics are used to determine the statistical significance of difference between the item loadings in two groups. No significance ($p>.05$) suggests that there is measurement invariance between two groups; therefore the groups are suitable for comparison.

There are several techniques to assess the significance of the differences between the path coefficients of each group. On his PLS FAQ website, Chin suggests that when standard errors are equal, the t-statistic for the differences between the path coefficients can be calculated using the following formula (Eberl, 2010; Keil et al., 2000; Kock, 2013). This approach was called the Pooled Standard Error method.

$$t = \frac{\beta_1 - \beta_2}{\left(\sqrt{\frac{(N_1 - 1)^2}{(N_1 + N_2 - 2)} * {S_1}^2 + \frac{(N_2 - 1)^2}{(N_1 + N_2 - 2)} * {S_2}^2}\right) * \left(\sqrt{\frac{1}{N_1} + \frac{1}{N_2}}\right)}$$

Respectively, β_1 and β_2 are the path coefficient values, S1 and S2 are the standard errors for the first and the second Group, N_1 and N_2 are the sample size of the first and the second group.

When standard error for the groups is unequal, the t-statistic for the differences between the path coefficients can be calculated using the formula below. This is referred to as the Satterthwaite method (Eberl, 2010; Kock, 2013).

$$t = \frac{\beta_1 - \beta_2}{\sqrt{{S_1}^2 + {S_2}^2}}$$

Respectively, β_1 and β_2 are the path coefficient values, S1 and S2 are the standard errors for the first and the second Group.

4.5 Qualitative data collection

The following sections describe approaches to the collection of qualitative data.

4.5.1 Open-ended questions in the survey

Some of the qualitative data were collected through open-ended questions in the questionnaire. An open-ended question was added at the end of each section of the questionnaire, which enabled participants to elaborate on their ideas and perceptions and allowed them to comment on their answers to the closed questions in the respective sections.

4.5.2 Interview questions

Semi-structured interview questions were developed after the quantitative data analysis. There are four sections in the interview schedule. In the first section, some general questions were asked about participants' perceptions on the policies in their organisations, and why the discussions between them and their colleagues were successful or unsuccessful. The second section focused on their media choice and the communication pattern. The third section focused on how the relationship between them and their colleague affected the discussion. In the fourth section,

some general questions were developed to collect participants' suggestions about how organisations could facilitate organisational policy knowledge. An example of the interview schedule is presented in appendix G.

4.5.3 Interview description

At the end of the questionnaire, participants were offered the option to be involved in an interview. Initially 12 participants showed interest in being interviewed, but five of them refused the invitation due to various reasons. Therefore a total of seven participants were included in the qualitative data collection. Because all interview participants were self-selected, no selection criteria were applied.

The interviews were carried out during March and April. They were conducted using Skype for geographical reasons and convenience. They were recorded using the Mp3 Skype Recorder software with the permission of the participants.

4.6 Approach to qualitative data analysis

The qualitative data was analysed following the approach suggested by Patton (2002). The procedure is presented in figure 4.3.

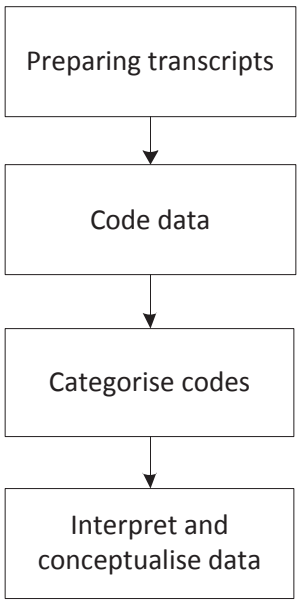

Figure 4.3. Procedures of qualitative analysis. Adapted from "Qualitative research and evaluation methods", by Patton, 2002, p 463-468

Firstly, the interview transcriptions were read several times to gain a broad understanding. While reading, side notes were added to the units (e.g. sentences of text) that were meaningful by their own. Then units under the same topic or related to each other were coded and classified. Patton suggests that developing some manageable classification or coding scheme is the first step of qualitative analysis, which could identify patterns from the data (Patton, 2002, p. 463). During the coding process, units were compared to each other and were labelled with one of the existing codes, or a new code was introduced when the unit suggested a new theme or topic. The coding process was repeated several times, during which the codes were amended, added, or removed as necessary. The coding process continued until no new codes were founded, and all units that were meaningful were properly labelled.

After the transcripts were coded, codes were classified into categories. Patton (2002, p. 465) suggests that there are two criteria in categorisation process: internal homogeneity, which means that codes in the same category should hold together in a meaningful way; external heterogeneity, which means that meanings of codes in different categories should be distinct. In most cases, a code would be assigned into a single category, but occasionally, a cade would fit in more than one category and therefore were prioritised into one of the categories based on the importance of the code, feasibility of fitting in the category, and the relevance to this study. The categorisation process was carried out back and forth until all codes were categorised following a clear pattern.

Finally, the code and categories were interpreted and conceptualised as a narrative description.

4.7 Ethical considerations

Ethical consideration was discussed with the supervisors of this study regarding the content of the survey and the interviews, as well as the research design. In

compliance with the Massey University Code of Ethical Approval (MUCEA), it was concluded that this study will cause no harm to participants because the participation was voluntary and confidentiality was ensured. By completing the Screening Questionnaire to Determine the Approval Procedure, this study was determined to be low risk, therefore a Low Risk Notification Form was completed. The screening questionnaire and the low risk notification were then submitted to, and later approved by, Massey University Human Ethics Committee (MUHEC) (See Appendix F).

4.7.1 Quantitative study

An invitation letter (See appendix B) and an information sheet (See appendix C) were sent to the participant along with the questionnaire. In the invitation letter, it was stated that by completing the questionnaire, participants gave their consent to be involved in this study. In the information sheet, participants' were informed of their rights and how the data would be used and stored.

4.7.2 Qualitative study

Permission to digitally record the interview was asked at the beginning of the interview. Participants were notified that they could request to pause or stop recording at any stage of the interview, they could refuse to answer any questions and they could voice their opinion during the interview. At the end of the interview, they were informed that they could withdraw themselves or the data they provided from this study at any time prior to data analysis. Pseudonyms are used in order to ensure anonymity and confidentiality when presenting the qualitative result.

4.8 Summary

A mixed research method involving a survey and semi-structured interviews was used in this study. Quantitative data were collected via online and paper based questionnaire, with discussions as unit of analysis, and university teachers in New Zealand in the disciplines of human health and medicine as the population. The

sample included the whole population and the contact details were obtained from university websites.

The measures for the construct included in the research model were adapted from prior studies, with additional questions eliciting information about communication pattern. The survey was tested for readability before sent to participants, and was carried out in two phases. The initial email and the first reminder were sent online, with the second reminder send via regular mail.

Interview questions were developed based on the feedback from the questionnaire. The questions focused on the mechanisms behind the hypotheses found to be significant, as well as participants' perceptions about policy and media use. All of the participants who wished to be interviewed were interviewed. Both interview transcript and answers to the open-questions in the survey were treated as qualitative data and were analysed following approach from Patton (2002).

Several steps were taken to minimise harm to the participants, including voluntary participation, ensuring confidentiality, and obtaining consent for recording the interviews.

CHAPTER 5. QUANTITATIVE DATA ANALYSIS

5.1 Response rate

A total of 1640 surveys were emailed to university teachers. Two hundred and thirty eight responses were received, of which 226 responses were usable. Eleven responses were unusable as the respondents did not complete the survey. The final response rate for the survey study was 13.8% (226/1640).

The response rate was low for various reasons. Firstly, participants may not have had the experience of discussing policies with their colleagues, or any discussions that was detailed enough to respond to the survey. Secondly, the timing of the survey was likely disrupted by Christmas and New Year holidays. Thirdly, participants' contacts were collected from university websites, some of which may have been invalid or outdated.

5.2 Preliminary analysis

This section presents the results of procedures used to purify data and to check the data admissibility for model testing using structural equation modelling that including accessing normality, checking outliers, and the steps of dealing with missing values. Data preparation and preliminary analysis were carried out using Microsoft Excel 2010 and SPSS version 21.

5.2.1 Normality and outliers

Normality was assessed by running Kolmogov-Smirnov statistics on each of the variables, assessing skewness and kurtosis values, as well as by visual inspection of the shape of the distribution of the variables in the histograms. At the significant level p=0.5, all items violated the assumption of normality in Kolmogorov-Smirnov statistics. However, the Skewness and Kurtosis values are below 3 and 10

respectively, following criteria set out by Kline (2011), it suggested that the data was close to multivariate normal and can be used in PLS analysis.

Outliers were checked by visual inspection of box plots and comparing the original means with the 5% trimmed means of each variable. Several outliers were detected and they were original scores. Because they were not too different from the distribution, and the two mean values were very similar, these cases were retained for further analysis.

5.2.2 Missing values

Five cases were deleted as they had more than 10% missing values (as suggested by Hair, 2009) . Then the randomness of missing values was checked using Little's MCAR test. As this showed no statistical significance at the level of 0.5, it was concluded that values were missing completely at random, and missing value imputation was appropriate. The Expectation-Maximisation method (EM method) was used to replace all missing values.

5.2.3 Non-response bias

To test for non-response bias, responses from early respondents (people who responded before the second reminder) were compared with responses from late respondents (people who responded after the second reminder). Following procedures outlined in Pallant (2010), a Mann-Whitney U test was applied to each of the items measuring tacit knowledge transfer success and Relationship constructs to compare early responses (N = 173) and late responses (N = 48).

Table 5.1 presents the mean and the two tailed *p*-value for each item in the tacit knowledge transfer success construct. At the significance level of .05, there was no significant difference between early and late responses.

Table 5.1

Result of non-response bias test based on items used to measure tacit knowledge transfer success

	Response		Mean Rank		
Item	Early	Late	Early	Late	*p*
TKTS01	173	48	107.49	123.64	0.117
TKTS02	173	48	107.81	122.51	0.155
TKTS03	173	48	106.70	126.50	0.055
TKTS04	173	48	111.23	110.18	0.919
TKTS05	173	48	108.59	119.70	0.284
TKTS06	173	48	108.21	121.07	0.214
TKTS07	173	48	109.80	115.31	0.595
TKTS08	173	48	109.83	115.22	0.599
TKTS09	173	48	109.28	117.19	0.445
TKTS10	173	48	108.25	120.90	0.221
TKTS11	173	48	107.61	123.21	0.132
TKTS12	173	48	109.06	117.99	0.389

Table 5.2 presents the mean and the two-tailed *p*-value for each item measuring constructs related to Relationship Strength. At the significance level of .05, there was no significant difference between early and late responses.

Table 5.2

Result of non-response bias test based on items used to measure constructs related to Relationship Strength

	Response		Mean Rank		
Item	Early	Late	Early	Late	P
Rela01	173	48	109.60	116.05	0.528
Rela02	173	48	108.75	119.11	0.317
Rela03	173	48	109.11	117.81	0.401
Rela04	173	48	110.37	113.26	0.775
Rela05	173	48	108.18	121.17	0.210
Rela06	173	48	109.82	115.25	0.600
Rela07	173	48	109.01	118.19	0.368
Rela08	173	48	113.95	100.36	0.185
Rela09	173	48	111.22	110.20	0.920
Rela10	173	48	112.50	105.59	0.503

As a result, no tests comparing early and late responses found any significant differences, thus there is no evidence of response bias.

5.2.4 Representativeness of the population

Table 5.3 presents the result of Chi-square good of fitness for gender and age percentage differences between the dataset and the overall population. The overall population of New Zealand university teachers consisted of 54% males and 46% females in 2010. However there were 37.1% males and 58.4% females in the dataset. Using a Chi-square goodness of fit test, it was found that there was a significant difference between the two ratios (χ^2 = 39.785, *df* = 3, *p* = .000). Because there is no detailed information about gender distribution across different disciplines, the cause of the difference cannot be determined. On the other hand, the age distribution of the dataset was similar to the age distribution of the overall population. Performing a Chi-square test for goodness of fit, there was no significant difference between the two ratios (χ^2= 11.252, *df*= 8, *p*= 0.188), suggesting that the dataset was representative of New Zealand university teachers.

Table 5.3

Comparison of gender and age percentage between data set and overall population

	Gender				Age		
	Dataset		Overall[a]		Dataset		Overall[a]
	N	%	%		N	%	%
Male	82	37.1%	54%	under 35	28	12.7%	18%
Female	129	58.4%	46%	35-39	28	12.7%	12%
				40-44	24	10.9%	13%
				45-49	33	14.9%	14%
				50-54	33	14.9%	14%
				55-59	36	16.3%	13%
				60-64	26	11.8%	10%
				65 and over	8	3.6%	7%
No response[b]	10	4%		No response[b]	5	2.3%	
Total	221	100%	100%	Total	221	100%	100%

[a] Source: Nana, G., Stokes, F., & Lynn, A. (2010). *Academic Workforce Planning - Towards 2020*. Wellington: Business and Economic Research Limited. [b] Participants did not provide this information

5.3 Descriptive statistics

This section presents the descriptive statistics relating to all variables. Mean scores were calculated on an 11-points scale: 1=strongly disagree, 12=strongly agree, 6=the mid-point of the scale.

5.3.1 Media choice

Table 5.4 presents the media choice of the participants. As seen in the table, the majority of the participants (47.5%, N=105) discussed organisational policy using only face to face communication. Twenty four percent (N=54) of the participants used a mix of face-to-face and email communication, 1.4% (N=3) of the participants used a mix of face-to-face and voice mail communication, and 0.5% (N=1) of the participants used a mix of face-to-face and instant messaging communication.

Overall, face-to-face communication was the first choice of media for discussion of policy (a total of 74.8%, N=163), while it was supplemented by other means of communication.

As seen in the table, email communication was the second popular media choice. Although a relatively small number of the participants (5.9%, N=13) discussed using email only, email was widely used in combination with other communication media, such as face-to-face (24.4%, N=54), telephone (8.1%, N=16), and video conferencing (1.4%, N=3). Overall, 39.8% (N=86) of the participants used email communication when discussing policy.

As to other communication media, 15.3% (N=34) of the participants used the phone to discuss policy; video conferencing (4.6%, N=10) and instant messaging (1.4%, N=3) were rarely used. Overall, in the discussions on policy, 57% (N=128) of the participants used only synchronous media, 36.7% (N=79) of the participants used a mix of synchronous and asynchronous media, and 6.4% (N=14) of the participants used only asynchronous media.

Table 5.4

Participants' choice of communication media

	Frequency		Percent	
Face to Face	105		47.5%	
Video conference	5		2.3%	
Phone	18		7.2%	
Synchronous media total		*128*		*57%*
Email	13		5.9%	
Voice mail	1		0.5%	
Asynchronous media total		*14*		*6.4%*
Face to face + Email	54		24.4%	
Face to face + IM	1		0.5%	
Face to face + Voice mail	3		1.4%	
Video Conference + Email	3		1.4%	
Video conference + IM	2		0.9%	
Phone + Email	16		8.1%	
Mixed media total		*79*		*36.7%*
Total	221		100.0%	

5.3.2 Relationship strength

As seen in table 5.5, the mean values of items measuring relationship strength are all greater than the mid-point of the scale, indicating that they had a reasonably close relationship with their colleague. Although most of the participants were comfortable communicating with their colleague and they trusted their colleague's willingness to help, as well as their knowledge regarding organisational policies, they were not as comfortable discussing private issues with their colleague, and did not feel particularly close to them.

Table 5.5

Items measuring relationship strength

Measures	Code	N	Min	Max	Mean	S.D.
I feel comfortable using informal language with the colleague	Rela01	221	1	11	8.4	2.86
I feel comfortable discussing personal issues with the colleague	Rela02	221	1	11	7.0	3.25
I feel comfortable discussing private issues with the colleague	Rela03	221	1	11	6.6	3.49
I feel comfortable communicating with the colleague	Rela04	221	1	11	8.8	2.69
I feel close to the colleague	Rela05	221	1	11	6.8	2.93
I feel know the colleague well	Rela06	221	1	11	7.5	2.66
If I required help, the colleague would help me	Rela07	221	1	11	8.7	2.74
The colleague knows my organisation's policies very well	Rela08	221	1	11	8.6	2.38
The colleague has good judgment in interpreting policies	Rela09	221	1	11	8.7	2.38
I can always rely on the colleague for help with problems around policy	Rela10	221	1	11	8.1	2.73

5.3.3 Tacit knowledge transfer success

As seen in table 5.6, the mean values of all items are greater than the mid-point of the scale, indicating that most of the participants felt the tacit knowledge transfer was successful. However, the mean score of the last two items were significantly lower than others. This is probably because tacit knowledge is highly personal and contextual, and the transfer of such knowledge does require time and effort to be spent on the interaction.

Table 5.6

Items measuring tacit knowledge transfer success

Measures	Code	N	Min	Max	Mean	S.D.
The discussion improved my understanding of the meaning of the policy	TKTS01	221	1	11	8.06	2.73
The discussion improved my understanding of the intent of the policy	TKTS02	221	1	11	7.91	2.56
The discussion increased my knowledge of the content of the documents describing the policy	TKTS03	221	1	11	8.04	2.32
The discussion improved my ability to access the documents describing the policy	TKTS04	221	1	11	7.45	2.8
The discussion increased my understanding of how the policy relates to other policies	TKTS05	221	1	11	7.06	2.6
The discussion improved my ability to ask penetrating questions about the policy	TKTS06	221	1	11	7.64	2.8
The discussion improved my ability to create documentation based on the policy	TKTS07	221	1	11	7.02	2.95
The discussion improved my ability to take the policy into account when making decisions	TKTS08	221	1	11	8.44	2.69
The discussion improved my ability to make suggestions regarding policy development	TKTS09	221	1	11	7.03	3.24
I learned from the discussion more than I initially expected	TKTS10	221	1	11	7.39	2.63
The discussion took more effort than I initially expected	TKTS11	221	1	11	6.75	3
The discussion took more time than I initially expected	TKTS12	221	1	11	6.24	3.16

5.3.4 Communication patterns

Although not included in the structural model, the measurement of the communication patterns provided information on how the communications media were used during the interaction, and contributed significantly to the development of interview questions.

As seen in table 5.7 and 5.8, the mean values of the items measuring velocity are much greater than the mid-point of the scale, suggesting that the discussion between the participants proceeded very quickly both when using synchronous media and asynchronous media. The mean values of items measuring velocity in table 5.7 are slightly greater than the respective mean values in table 5.8, suggesting that the participants' perception on velocity was higher when using synchronous media than it was when using asynchronous media.

As seen in table 5.7, although gestures and body postures were less used, voice intonation and facial expression were used a lot when using synchronous media. As seen in table 5.8, asynchronous media provide a limited ability to deliver natural language, and unsurprisingly text appearances and emoticons were rarely used.

As seen in table 5.7 and 5.8, although the mean values of items measuring rehearsability and reprocessability are low, the mean values in table 5.8 are notably greater than the respective values in table 5.7, suggesting that the participants were more likely to rehearse and reprocess messages when using asynchronous media.

Table 5.7

The pattern of synchronous media use

Measures	Code	N	Min	Max	Mean	S. D.
Velocity						
I provided immediate feedback to the colleague	Syn01	207	1	11	8.3	2.49
The colleague provided immediate feedback to me	Syn02	207	1	11	8.6	2.35
The discussion proceeded very quickly	Syn03	207	1	11	8.5	2.13
Language naturalness						
I used gestures to express my attitude to policy related issues	Syn04	207	1	11	6.4	3.54
I used voice intonation to express my attitude to policy related issues	Syn05	207	1	11	8.1	2.97
I relied on body posture to express my attitude to policy related issues	Syn06	207	1	11	5.9	3.40
I used facial expressions to express my attitude to policy related issues	Syn07	207	1	11	7.4	3.12
My colleague used gestures to express attitude to policy related issues	Syn08	207	1	11	6.8	3.27
My colleague used voice intonation to express attitude to policy related issues	Syn09	207	1	11	7.3	3.03
My colleague relied on body posture to express attitude to policy related issues	Syn10	207	1	11	5.9	3.40
My colleague used facial expressions to express attitude to policy related issues	Syn11	207	1	11	7.2	3.01
Rehearsability						
I carefully planned my verbal statements in advance	Syn12	207	1	11	5.4	3.30
Reprocessability						
I frequently interrupted the discussion to look up saved messages relevant to the discussion	Syn13	207	1	11	4.7	3.29

My colleague frequently interrupted the discussion to look up saved messages relevant to the discussion	Syn14	207	1	11	4.7	3.07

Table 5.8

The pattern of asynchronous media use

Measures	Code	N	Min	Max	Mean	S. D
Velocity						
I provided immediate feedback to the colleague	Asyn01	92	1	11	7.8	2.80
The colleague provided immediate feedback to me	Asyn02	92	1	11	7.6	2.84
The exchange of messages proceeded very quickly	Asyn03	92	1	11	8.0	2.29
Language naturalness						
the colleague relied on emoticons to express attitude to policy related issues	Asyn04	92	1	11	3.4	3.19
I relied on emoticons to express attitude to policy related issues	Asyn05	92	1	11	3.3	3.19
the colleague relied on text appearance to convey information	Asyn06	92	1	11	3.3	2.95
I relied on text appearance to convey information	Asyn07	92	1	11	3.2	2.93
Rehearsability						
I spent a lot of time to edit messages before sending them	Asyn08	92	1	11	6.2	3.18
I formulated my messages with a lot of care (edit messages multiple times before sending)	Asyn09	92	1	11	6.7	3.36
Reprocessability						
I spent a lot of time examining saved messages	Asyn10	92	1	11	5.7	3.80

5.4 Checking for common method bias

As described in section 4.4.3.1, Harman's single factor test was used to check common method bias. With eigenvalue greater than 1, the test resulted in 11 factors that explained 88.1% of variances, suggesting that the survey was not affected by common method variances. To make the evidence more solid, exploratory factor analysis was rerun by fixing the number of extracted factors to 1, this resulted in a single factor that explains 36.4% of total variance, which did not account for the majority of the covariance between measures. Therefore, the result of the Harman's test suggests that common method variance was not a problem (see table 5.9).

Table 5.9

Exploratory Factor Analysis result

Components	Eigenvalues	Variance	Cumulative Variance
1	8.003	36.4%	36.4%
2	3.359	15.3%	51.6%
3	2.533	11.5%	63.2%
4	1.67	7.6%	70.8%
5	1.29	5.9%	76.6%

5.5 Group separation

As discussed in section 4.4.4, in order to investigate how media use moderated the effect of relationship strength on tacit knowledge transfer success, the dataset was separated according to the participants' media choice.

Group 1 (N=128) included all participants who used only synchronous media when discussing policy with their colleague. Group 2 (N=79) included all participants who used both synchronous media and asynchronous media at the same time. Group 3 (N=14) included all participants who used only asynchronous media when discussing policy with their colleague. Because the sample size of group 3 was too small, the model was tested only with Group 1 and Group 2.

5.6 Testing the measurement model - exploratory factor analysis on the construct of relationship strength

Initially, the model measured relationship strength as a single construct, and the items were adapted from Carlson and Zmud (1999) and Mcknight et al. (2002). In the measurement model testing in PLS analysis, several items were loaded on the construct below the threshold of 0.6 recommended by Chin (1998) in both Group 1 and Group 2. Because the items with low loadings were from a difference source to other items, and the concept of Relationship was multi-dimensional, it seemed possible that the low loadings may have been caused by multidimensionality.

An exploratory factor analysis was conducted to explore the dimensionality of the construct. Nunnally (1978) recommended a sample to item ratio of 10/1 for a dataset to be suitable for factor analysis, however other researchers argue that a ratio of 5/1 is adequate for most cases (Tabachnick & Fidell, 2001). As there were 10 items measuring the relationship construct and 128 samples in Group 1, the sample size met the requirement of factor analysis. The sample to item ratio of Group 2 was 7.8:1, less than the ratio recommended by Nunnally, but greater than the ratio recommended by Tabachnick and Fidell. Therefore the sample size was considered to be adequate for factor analysis.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity were used to test whether the relationship between items was strong enough for factor analysis. The Kaiser-Meyer-Olkin value was .764 for Group 1 and .771 for Group 2, greater than the recommended threshold of .6, and the Bartlett's Test of Sphericity was statistically significant ($p<0.001$) for both groups suggesting the data was suitable for factor analysis (as shown in table 5.10).

Table 5.10

KMO and Bartlett's Test result

		Group1	Group2
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.764	0.771
Bartlett's Test of Sphericity	Approx. Chi-Square	786.695	1069.848
	df	45	45
	Sig.	.000	.000

For group 1, the factor analysis for the construct of relationship strength showed that there were two components with eigenvalues greater than one, and explained 51.6% and 23.4% of the variance respectively. For group 2, the factor analysis for the construct of relationship showed that there were two components with eigenvalues greater than one, and explained 52.9% and 19.5% of the variance respectively. The test result suggested that items measuring relationship strength should be divided into two components for both groups.

To interpret the result, oblimin rotation was used to generate the pattern of loadings of the items. As seen in table 5.11, for both groups, item Rela07 to Rela10 loaded high on component 1, item Rela01 to Rela06 loaded high on component 2. Three items were loaded on both components, based on their meaning item Rela04 was added to component 1 while items Rela08 in Group 1 and Rela07 in Group 2 were added to component 2.

Table 5.11

Factor analysis for measures of relationship strength

		Group 1 Component		Group 2 Component	
Measures	Code	1	2	1	2
Comfortable using informal language	Rela01		0.762		0.606
Comfortable discussing personal issues	Rela02		0.935		0.949
Comfortable discussing private issues	Rela03		0.903		0.909
Comfortable communicating with the colleague	Rela04	0.332	0.771	0.343	0.71
Feel close to the colleague	Rela05		0.775		0.754
Know the colleague well	Rela06		0.536		0.608
If I required help, the colleague would help me	Rela07	0.852		0.719	0.364
The colleague knows my organisation's policies very well	Rela08	0.923	-0.324	0.933	
The colleague has good judgment in interpreting policies	Rela09	0.964		0.956	
I can always rely on the colleague for help	Rela10	0.73		0.8	

The result of factor analysis indicated that construct relationship strength was multidimensional, and therefore was separated into two separate constructs: closeness and trust. The separation of constructs was supported by literature.

Corresponding to component 1, McKnight et al. (2002) suggest that people's perception of other's benevolence, integrity, and professionalism, as well as their willingness to depend on that person when a problem arises are aspects of trust. Such conceptualisation and similar measurements were used by several studies (Chiu et al., 2006; Levin & Cross, 2004). Therefore, component 1 was named trust.

Corresponding to component 2, Carlson and Zmud (1999) suggest that through on-going communications people develop social relationships where they not only close and familiar, but also communicate in a less formal and more involved way. This is similar to Hansen's (1999) conceptualisation of strong ties, that both emphasises the closeness and relaxed communication between individuals. Therefore, component 2 was named closeness.

Due to the multidimensionality of the Relationship Strength construct, the model was revised and is presented in section 3.4.

5.7 Testing the measurement model - PLS

The following sections present the result of measurement model testing. Construct validity was assessed by testing convergent validity and discriminant validity.

5.7.1 Convergent validity

Table 5.12 presents the item loadings on, and the AVEs of the constructs for both groups before items with low loadings were deleted. While Chin (1998) suggests that the loadings of indicators on their intended constructs should be above .6, Fornell and Larcker (1981) suggest that the AVE for all constructs should be above .5.

Table 5.12

Item loadings and AVEs before removing items with low item loadings

		Group 1		Group 2	
Construct	Item	Loading	AVE	Loading	AVE
Closeness			.59		.61
	Rela01	.81		.87	
	Rela02	.81		.84	
	Rela03	.75		.77	
	Rela04	.73		.68	
	Rela05	.76		.81	
	Rela06	.74		.68	
Trust			.77		.77
	Rela07	.91		.92	
	Rela08	.84		.77	
	Rela09	.93		.93	
	Rela10	.83		.89	
Tacit Knowledge Transfer Success			.44		.50
	TKTS01	.80		.89	
	TKTS02	.75		.88	
	TKTS03	.74		.83	
	TKTS04	.70		.60	
	TKTS05 [a]	.55		.59	
	TKTS06	.82		.89	
	TKTS07	.63		.62	
	TKTS08	.77		.82	
	TKTS09	.67		.65	
	TKTS10	.65		.85	
	TKTS11 [a]	.24		.23	
	TKTS12 [a]	.44		.38	

[a] items marked for deletion.

Based on Chin's (1998) suggestion, three items measuring tacit knowledge transfer success for both groups were deleted because they had a loading below .6. Loadings for item TKTS05 (Understand how the policy relates to other policies) on tacit

knowledge transfer success construct in groups 1 and 2 were .55 and .59 respectively. It is possible that participants only focused on the policy which they were applying and neglected its connections to other policies. The removal of this item did not affect the face validity of the construct, because to a large extent, the meaning of the construct was captured by the rest of the items.

Loadings for item TKTS11 (The discussion took more effort than initially expected) on tacit knowledge transfer success construct for both groups were .24 and .23 respectively. Loadings for item TKTS12 (The discussion took more time than initially expected) were .44 and .38 respectively. The unreliability of these items was likely caused by participants' different understanding of what can be considered as too much time and effort. Removing these items did somewhat change the meaning of the constructs, but made it more focused on Argote and Ingram's (2000) conceptualisation of knowledge transfer success.

After removal of the above items, loadings of all items on their intended constructs were greater than the recommended threshold of .6, and the AVE for each construct was greater than the recommended threshold of .5 (see Table 5.13).

Table 5.13

Item loadings and AVEs after removing items with low item loadings

		Group 1		Group 2	
Construct	Item	Loading	AVE	Loading	AVE
Closeness			.59		.60
	Rela01	.82		.87	
	Rela02	.80		.83	
	Rela03	.74		.76	
	Rela04	.75		.70	
	Rela05	.75		.81	
	Rela06	.74		.68	
Trust			.77		.78
	Rela07	.89		.91	
	Rela08	.84		.78	
	Rela09	.93		.93	
	Rela10	.84		.89	
Tacit Knowledge Transfer Success			.57		.62
	TKTS01	.86		.91	
	TKTS02	.81		.90	
	TKTS03	.81		.87	
	TKTS04	.62		.64	
	TKTS06	.86		.89	
	TKTS07	.64		.65	
	TKTS08	.79		.84	
	TKTS09	.62		.64	
	TKTS10	.74		.87	

Table 5.14 presents the AVE, reliability, and Cronbach's alpha for all the constructs in Group 1 and Group 2. For both groups, all constructs had AVE value between .57 and .78; composite reliability between .90 and .93, Cronbach's Alpha between .86 and .92, and therefore meet the convergent validity criteria.

Table 5.14

AVE, Composite reliability, and Crobach's Alpha

Construct	AVE		Composite Reliability		Cronbach's Alpha	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Closeness	.59	.60	.90	.90	.86	.87
Trust	.77	.78	.93	.93	.90	.91
TKTS	.57	.62	.92	.93	.91	.92

5.7.2 Discriminant validity

As described in section 4.4.5.1, discriminant validity was assessed by examining cross loadings of all items on any other constructs, as well as comparing the square root of the AVE for each construct with the construct's correlations with other constructs.

As show in Table 5.15, in group 1, all items loaded on their intended construct higher than any other constructs.

Table 5.15

Item loadings and crossloadings in Group 1

Item	Closeness	Trust	TKTS
Rela01	**.8177**	.4503	.4272
Rela02	**.8048**	.2945	.3939
Rela03	**.7422**	.2954	.2437
Rela04	**.7454**	.5123	.3571
Rela05	**.7523**	.455	.1775
Rela06	**.7384**	.3924	.3945
Rela07	.7318	**.8949**	.3706
Rela08	.3016	**.8448**	.2546
Rela09	.4716	**.9342**	.2566
Rela10	.4687	**.8431**	.2084
TKTS01	.2529	.2044	**.8603**
TKTS02	.2975	.1693	**.8105**
TKTS03	.2644	.2173	**.8144**
TKTS04	.2373	.1443	**.6245**
TKTS06	.4324	.2207	**.8586**
TKTS07	.3036	.1616	**.6436**
TKTS08	.5156	.5333	**.7851**
TKTS09	.38	.0885	**.6171**
TKTS10	.2053	.2263	**.7416**

Note. Numbers in bold correspond to item loadings on their own constructs.

As shown in Table 5.16, in group 2, all items loaded on their intended construct higher than any other constructs.

Table 5.16

Item loadings and crossloadings in Group 2

	Closeness	Trust	TKTS
Rela01	**.8735**	.4042	.6319
Rela02	**.827**	.2713	.5284
Rela03	**.7586**	.2076	.428
Rela04	**.6984**	.4538	.4458
Rela05	**.8095**	.46	.3445
Rela06	**.6805**	.3458	.4667
Rela07	.5948	**.913**	.3614
Rela08	.1172	**.7846**	.1694
Rela09	.3901	**.9334**	.2721
Rela10	.5716	**.8882**	.4391
TKTS01	.5717	.4131	**.9134**
TKTS02	.5919	.308	**.9006**
TKTS03	.4977	.4153	**.8712**
TKTS04	.1429	.1187	**.6432**
TKTS06	.5869	.3025	**.8905**
TKTS07	.3679	.0559	**.6521**
TKTS08	.5448	.4962	**.835**
TKTS09	.3456	-.0356	**.6412**
TKTS10	.5552	.3652	**.8672**

Note. Numbers in bold correspond to item loadings on their own constructs.

Table 5.17 and Table 5.18 present the comparison between the square root of AVE of each construct and the correlations of the construct to other constructs. As seen in the tables, the square root of the AVE for each construct was greater than the correlation of that construct with other constructs for both groups. All results suggested good discriminant validity for constructs for both Group 1 and Group 2.

Table 5.17

Square root of AVE and latent variable correlations for Group 1

	Closeness	Trust	TKTS
Closeness	**.767**		
Trust	.590	**.880**	
Success	.462	.334	**.756**

Note: Numbers on the diagonal (given in bold) are square roots of AVE, and items off the diagonal are correlations.

Table 5.18

Square root of AVE and latent variable correlations for Group 2

	Closeness	Trust	TKTS
Closeness	**.778**		
Trust	.536	**.882**	
Success	.636	.402	**.785**

Note: Numbers on the diagonal (given in bold) are square roots of AVE, and items off the diagonal are correlations.

5.8 Testing the structural model

The following sections present the PLS analysis for the structural model for both Groups, as well as a comparison of the path coefficient between the two groups.

5.8.1 Path coefficient and model testing

The structural model testing result is presented in figure 5.2 and figure 5.3 for Group 1 and Group 2 respectively, with the solid line indicating confirmed hypothesis and the dashed line indicating unsupported hypothesis. Path coefficient values are given under hypothesis numbers, with corresponding *p*-values in the brackets. The R^2 value is also given under the dependent variable.

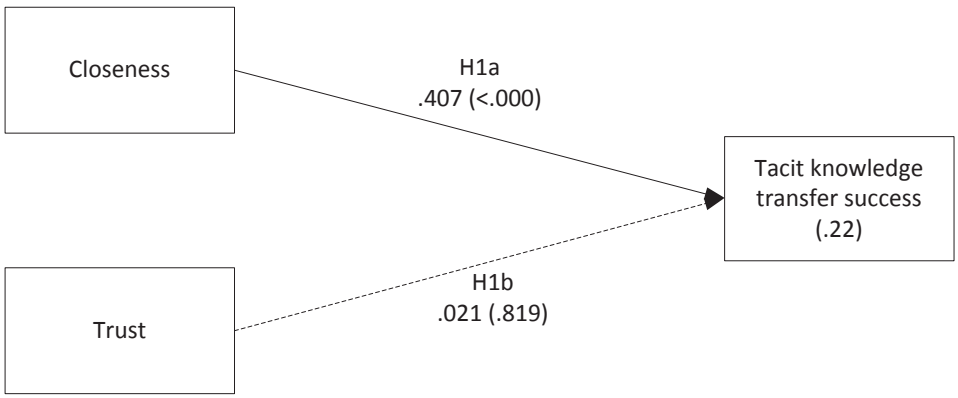

Figure 5.1. The structural model testing result for group 1 (the participants used synchronous media).

As seen in figure 5.2, for Group 1, Closeness positively affected Tacit Knowledge Transfer Success with β=.407. However, the path coefficient value between Trust and Tacit Knowledge Transfer Success was low (β=.021), indicating that there was not a significant relationship between these two constructs (p=.819).

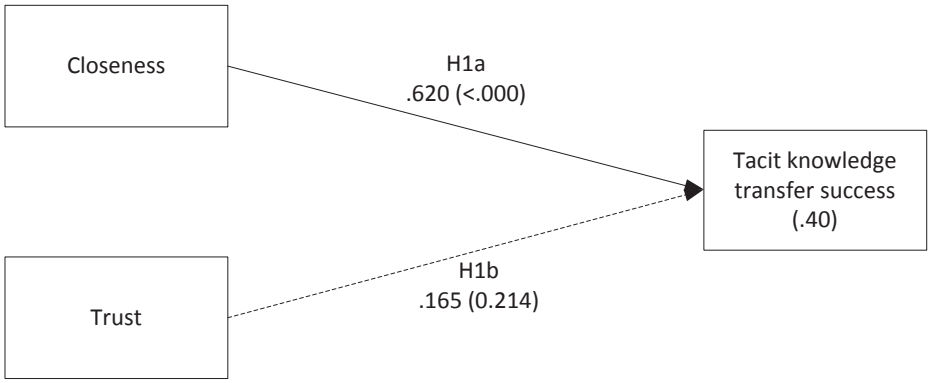

Figure 5.2. The structural model testing result for group 2 (the participants used both synchronous and asynchronous media).

As seen in figure 5.3, for Group 2, Closeness positively affected Tacit Knowledge Transfer Success with β=.620, p<.000. However, similar to the model testing for Group 1, the path coefficient value between Trust and Tacit Knowledge Transfer Success was low (β=.165), indicating that there was not a significant relationship between these two constructs (p=.214).

Based on the structural model testing result for both groups, H1a (A *Higher level of Closeness between individuals leads to better tacit knowledge transfer success*) was supported but H1b (A *Higher level of trust between individuals leads to better tacit knowledge transfer success*) was not supported.

5.8.2 Effect size

Respectively, path coefficient values for H1a for Group 1 and Group 2 were .407 and .620, indicating medium and large effect size according to suggestions from Kline (2011). Respectively, R^2 values for the dependent variable for Group 1 and Group 2 were .22 and .40, indicating weak and average predictive power according to Chin (1998).

5.8.3 Group comparison

Because the relationship between trust and tacit knowledge transfer success was not statistically significant, only the path coefficient of Closeness → Tacit Knowledge Transfer Success was tested for statistical significance between groups.

Table 5.19 presents the path coefficient value and standard error for Closeness → Tacit Knowledge Transfer Success from bootstrap analysis, as well as the sample size for corresponding groups.

Table 5.19

Path coefficient, standard error, and sample size

	Path coefficient	Standard error	Sample size
Group 1	0.4071	0.0581	128
Group 2	0.6205	0.0854	79

As discussed in section 4.4.5.3, before testing for group differences, measurement invariance was assessed using the following equation.

$$t = \frac{Loading_1 - Loading_2}{\sqrt{{S_1}^2 + {S_2}^2}}$$

Table 5.20 presents the result for the assessment of measurement invariance. As a result, no significance was found at p=.05, suggesting group comparison was appropriate.

Table 5.20

Measurement invariance test result

	Loading 1	Loading 2	*S* 1	*S* 2	T value	*P* value
Rela01	.8177	.8735	.0581	.0854	-0.540	.59
Rela02	.8048	.827	.0581	.0854	-0.215	.83
Rela03	.7422	.7586	.0581	.0854	-0.159	.87
Rela04	.7454	.6984	.0581	.0854	0.455	.65
Rela05	.7523	.8095	.0581	.0854	-0.554	.58
Rela06	.7384	.6805	.0581	.0854	0.561	.58
TKTS01	.8603	.9134	.0581	.0854	-0.514	.61
TKTS02	.8105	.9006	.0581	.0854	-0.872	.38
TKTS03	.8144	.8712	.0581	.0854	-0.550	.58
TKTS04	.6245	.6432	.0581	.0854	-0.181	.86
TKTS06	.8586	.8905	.0581	.0854	-0.309	.76
TKTS07	.6436	.6521	.0581	.0854	-0.082	.93
TKTS08	.7851	.835	.0581	.0854	-0.483	.63
TKTS09	.6171	.6412	.0581	.0854	-0.233	.82
TKTS10	.7416	.8672	.0581	.0854	-1.216	.23

The absolute difference between the standard error of two groups was:

$$0.0854\text{-}0.0581=0.0273,$$

With the standard value not being Equal, the Satterthwaite method should be used to test group difference (see discussion in section 4.4.5.3).

Enter parameters in table 5.19 into the equation,

$$t = \frac{\beta_1 - \beta_2}{\sqrt{{S_1}^2 + {S_2}^2}}$$

Therefore

$$t = \frac{0.4071 - 0.6205}{\sqrt{0.0581^2 + 0.0854^2}}$$

Therefore,

$$t = -2.0660$$

With a *t* value, it can be calculated that

$$p = .040 \ (p < .05)$$

it was found that the difference of the path coefficient between Group 1 and Group 2 was significant at *p*=.05. Therefore, H2a (*The effect of closeness between individuals on tacit knowledge transfer success is stronger when people use both synchronous and asynchronous media than when people use only synchronous media*) was supported.

5.9 Summary

This chapter presents the results of the quantitative data analysis. The response rate was 13.8%, with 207 data used for the model test. Although the data violated the assumption of normal distribution, it was close to multivariate normal, and was appropriate for PLS analysis. Several outliers were detected and they were retained for analysis as they were not too different from the distribution. Three cases were deleted due to more than 10% missing values. The rest of the missing values were missing completely at random, and were imputed using the Expectation Maximisation method. The dataset showed no evidence of non-response bias; and by comparing the demographic information of the participants with information from government reports, it could be determined that the dataset was the representative of the population.

Overall face-to-face communication and email were the two mostly used communication media when the participants were discussing policy. The additional

measurements demonstrated the differences between communication patterns of when people were using synchronous media and when they were using asynchronous media.

Exploratory factor analysis indicated that the construct relationship strength was multidimensional, and according to theory from prior literature it was separated into two construct, namely closeness and trust. The structural model was therefore revised and the hypotheses were restated.

Several items were deleted due to low item loadings on the respective construct. It was concluded that the influence of dropping of these items on the content of the construct was minor. After the deletion, the measurement model fulfilled all the criteria of convergent and discriminant validity.

Structural model testing results were presented. While the effect of trust on tacit knowledge transfer success was not supported for both groups, closeness affected tacit knowledge transfer success with a medium and large effect size in Group 1 and Group 2 respectively. Group comparison showed that the differences between the path coefficients of Group 1 and Group 2 were statistically significant, therefore it supported the hypothesis that the effect of closeness between individuals on tacit knowledge transfer is stronger when people use both synchronous and asynchronous media than when people use only synchronous media.

CHAPTER 6. QUALITATIVE ANALYSIS

6.1 Introduction

The following sections present the findings of the qualitative data analysis. As described in section 4.5, qualitative data were obtained from two sources: through answers to the open-ended questions incorporated in the survey (see section 4.5.1), and through semi-structured interviews (see section 4.5.2). A total of six participants (four female, two male) were interviewed.

6.2 Knowledge about interpreting and implementing policy

6.2.1 Difficulties of policy interpretation and implementation

The interviewees tended to think of policy as broad and generic. They believed that people's work was strongly influenced by the policies of the organisation. While Sue suggested that organisational policy "should" have an impact on every aspect of work, others felt that good policy clarified the intentions of the policy while not tying people down to the detail. Policies provided the "spirit of how something should be approached, rather than the detail". It was also pointed out by one interviewee that policy was less useful in intangible situations. This is consistent with Robbins and Coulter's (2007) conceptualisation of policy.

Interpreting and implementing policies was a problem in some situations. Sometimes workers were not aware that a particular policy existed. As May said:

> *Policies are not treated as a proactive thing – people often don't even know they exist… In fact, in discussions with colleagues often when I said there is a policy on this, they sort of looked at me and just said "oh, I didn't know there were policies".*

This interviewee found that even when people knew there was a policy, they often chose not to look at it and instead relied on their own judgement to make a decision. She said that most people did not bother to read or look at the policies but tended

to do things the way they had customarily done them, or use the “unwritten this is how it’s done” rule, and only looked for guidance from policy after a problem had occurred.

A further difficulty arose when people knew of the existence of a policy but did not know how or where to find it. May pointed out that when you knew how to find the policies it was a relatively easy process, but if a person was unfamiliar with policy procedures then it became difficult. Sam said the structure of his organisation’s website was overly complicated, such that he would never be able to find the document describing any policy.

Some participants found policy was hard to understand due to poor writing or poor formatting. In the answer to the open-ended question, one participant was not satisfied about the format and the writing of a certain policy. He commented that a “particular policy statement was framed without references, was poorly constructed ideologically, and woefully inadequate grammatically”. Several interviewees thought some policies were made by people who did not understand the context and the situation in which the policy was implemented, therefore creating difficulties for its interpretation and implementation. They felt that the designers of policy did not understand the reality. Amy stated:

> *When discussing policies with colleagues we all agree that they are more or less impossible to follow because they have been written by 'ivory tower' people who have no idea of the difficulties in teaching students in clinical settings, off-campus, and with little or no support from university infrastructures, and where the teaching activities actually cost teachers.*

A similar comment was made in the answer to the open-ended questions in the survey, where one participant wrote:

> *The discussion demonstrated to me how meaningless this particular policy document is for my individual situation and how those who developed the document have no understanding of what completing and submitting the document means when it does not pertain to an individual situation.*

As a result of the disconnection between the policy makers and the situation in which the policy is implemented, parties affected by a policy may not agree with what the policy proposes. Such a lack of consensus across all stakeholders tended to create barriers to policy interpretation and/or implementation. This lack of consensus between those who were implementing the policy and the policy makers, lead to a situation whereby those who were expected to implement the policy felt that the policy was "dictated" to them. Mark commented:

> *You have to have some sort of agreement from other people that it affected… There could be issues if the document proposes things you don't agree with… My feeling is, that if the document or the policy is imposed on you without consultation, [then it] is one that I will be inclined to ignore.*

A policy may conflict with other policies. When May was studying the recognition and implementation of the Treaty of Waitangi within the university, she found that the policy in the university took an approach that Maori language was an official language of the country, which conflicted with the "Crown-Maori partnership" approach which the Treaty of Waitangi embodied. Yet the two policies were closely aligned in terms of protecting Maori culture and encouraging the use of Maori language. She stated:

> *We were talking about the recognition and partnership of the Treaty of Waitangi within the university, so I went to look at the policy. It was really interesting because the policy really didn't take that partnership approach at all. It very much took the approach that Maori was an official language of the country… What was really interesting though, was that by taking that official language approach, it demeans the partnership approach*

What May has experienced is similar to Hier and Walby's (2013) observation on the installation of public camera surveillance in Canada (see discussion in section 2.3.3.3). In both cases, the conflict between policies enforces the individuals to rely on tacit knowledge to interpret and implement the policy.

Similar to Yanow's (1996) idea that the meanings of policy are carried by words, which is a symbol system that is open to multiple interpretations, Mark thought people had different interpretations of the same policy and that this was inevitable. He believed that these various interpretations needed to be taken into consideration when implementing any policy, and as a result, policy was "only one of the things" that needed to be taken into consideration.

In summary, participants suggested that there were several reasons why policies are sometimes difficult to interpret and implement. People may not look at the policies but simply rely on instinct and what has always been done previously. Sometimes when they do want to look at a particular policy it is difficult to find. At other times the policy is poorly written and/or there appears to be a disconnection between those who make the policy and those who implement it which can lead to a lack of agreement on the policy. Policies can also disagree with each other and because of the different perspectives from which people read policies there is the possibility of multiple interpretations of the same policy.

6.2.2 Transfer of policy knowledge

Policy knowledge is commonly passed on from the experience of colleagues. The participants in this research typically went to the policy makers themselves, or their superiors, when they required clarification and/or explanation of policy. In particular, workers who were new to an organisation relied on other experienced people to tell them how a policy was usually interpreted, and explaining the normal format for implementing a particular policy. When Catherine, a relatively new employee, had to deal with students who were cheating, she consulted with a colleague who had experience in dealing with such matters. She explained that while she had the written policy, her colleague was able to clarify the process and tell her what to do. Because of that colleague's experience and understanding of the way in which things were done "she is frequently the person that I go to for help". Mark believed that his colleagues' experience was the most valuable for him, "because they can recall when

they reacted to similar situations, whether or not they were successful, and why they were successful (or not)". Interactions with colleagues often lead to understanding things differently and becoming aware of issues about which they would otherwise be ignorant.

In summary, interactions with people who have experience on policies are the main source of participants' policy knowledge, which is highly tacit.

6.3 The effect of personal relationships

Participants believed that when a strong personal relationship existed between themselves and their colleagues the transfer of policy knowledge was positively affected. Such a relationship often consists of frequent interactions, high levels of trust, and close personal ties.

Participants all agreed that a high level of trust was important for the transfer of policy knowledge. Mark believed that work was much easier when people trusted each other. When discussing policy related issues with her colleagues, May felt that because there was a high level of trust among them, the conversation was much more relaxed, and they were able to "have a casual conversation about an important and intense issue". She believed that when people trusted each other, the discussion was more honest and open. That is consistent with Davenport and Pruzak (2000) as well as Roberts' (2000) findings, which suggest that trust lowers the risks and uncertainties, and provides an "honest" and "open" atmosphere where tacit knowledge can be successfully transferred.

Participants agreed that a close personal relationship between individuals made communication more efficient, and therefore facilitated the transfer of policy knowledge. Catherine believed that personal relationships were built through interactions between herself and individual colleagues and this in turn affected the success of the interaction. It also supported a greater depth of communication. She believed that a good relationship made the communications "warmer, more

relaxed", and enabled them to talk on a personal as well as professional level. She felt that when she had this "personal connection" she was able to ask questions and feel safe to explore difficult ideas.

Mark agreed that a close relationship between his colleague and him made the communications more efficient. He believed that such closeness allowed them to understand and interpret each other's ideas quickly, and they were able to pick up more details during their discussions. He said:

> *You can come to the point more quickly when you know someone very well. If you don't know them very well, you need some time figuring out what kind of person they are, and how they are going to respond to you, and what their perspectives are, all that sort of thing. It's really hard to assess whether you are boring them or not or whether they believe, or you know, whether they are sceptical. All of these things are very hard to process if you don't know them.*

This is supported by Hasty et al. (2006) who found that individuals establish mutual understanding when they have a strong personal relationship, as this improves the efficiency of communication and further facilitates knowledge transfer between them.

6.4 Communication media

Participants interacted with their colleagues using a variety of communications media. They considered that some types of media facilitated the transfer of policy knowledge, while others hindered the transfer of such knowledge. Often participants tended to use the communications media that "got the best outcome", yet the choice of media was often constrained by time differences and the distance between them and their colleagues.

6.4.1 The use of face-to-face communication

Most participants described face-to-face communications as "the best", and the one that "dominates other forms of communication". In particular, they felt it was the

most effective and efficient media when discussing issues such as “controversial types of policy”.

One reason why participants preferred face-to-face communication was that it allowed people to understand each other very quickly. When commenting in the open-ended questions in the survey, a participant stated that compared to other types of media, face-to-face enabled quicker understanding of “subtle and complex issues”.

When discussing policy related issues, participants found that the use of body language, facial expression, and voice intonation enabled them to receive and deliver richer and more complex information. May stated that being able to pick up facial expressions and body language was incredibly valuable when dealing with controversial issues, and receiving an immediate response was also important when they were brainstorming. Other participants made similar comments; they believed the use of these natural communication cues helped people save time in a discussion by emphasising “important points”, and clarifying “difficult points”. Their comments are in alignment with prior studies such as Murray and Peyrefitte (2007) and Jasimuddin (2007), who have highlighted the importance of these communication cues for tacit knowledge transfer.

As Nonaka and Konno (1998) suggested, people exchange tacit knowledge between each other through social interaction. Catherine believed that face-to-face communication facilitated the transfer of policy knowledge not only by allowing the use of multiple communication cues, but also by supporting the development of the personal relationship. She stated that through face-to-face communication, people learn the whole pattern rather than only the ideas.

However, face-to-face communication is not always possible and raises some problems at times. Sue was concerned with the practicality of face-to-face communications. She believed that one of the major barriers for its use was the

"tyranny of distance"; people are not always in the same environment, and they face the challenge of time and distance. Additionally, Amanda thought one of the disadvantages was that *"you have no concrete evidence of what actually is discussed".*

Participants suggested that communication media such as video-conferencing allowed them to overcome some of the constraints of distance and provided a face-to-face-like environment. Sam had these virtual meetings very often because the members of his team were located distantly. He found video conferences and virtual meetings were very useful under such circumstances because these media allowed people to have discussions that offered many of the benefits of face-to-face meetings, (such as the ability to observe facial expressions and other cues) without the cost of having to travel. Being able to support people to "co-presence" without "co-location" (Boisot, 1998), these communication media have a great capability to support the transfer of policy related knowledge.

In summary, face-to-face communication was the first choice for discussing policy related issues. It allowed them to build mutual understanding very quickly, it delivered intended meaning through multiple cues, and it enabled them to establish personal relationships. Face-to-face communication was the first choice for participants to discuss "difficult points", "controversial issues", "interesting points", and "subtle and complex issues". However, new technologies such as video conferencing enabled many of the benefits of face-to-face without the constraints of travel and expense.

6.4.2 The use of email

Several participants pointed out that they used email to discuss policy related issues. They believed that the advantage of email communication when discussing policy was convenience, ease of use, and capability of information transmission and processing. Participants all agreed that one of the advantages of email communication was that people did not need to physically locate the communication

partners. Amy considered email an easy way to get the message to other people "*without actually having to physically be here*". Sue had similar comments about the advantages of email. Further, she believed that email could be used synchronously under certain circumstances. She stated: "Email communication, although it's not real time, in some instances it can be. If you are both sitting at the desk at the same time, you can get these points clarified quite quickly". In other words, while you cannot see or hear each other, you can respond to the other person in an almost real-time way.

When using email, participants felt that it was valuable to be able to spend time to process the received message rather than having to respond to it immediately. They were also able to revisit and reprocess received messages over time. As commented by Sue:

> *If you rely on email traffic, you can track the passages of the conversation, you can store them and you can go back to them another day. That can be valuable as well.*

Furthermore, Mark considered email communication an efficient way to make sure that everybody had a copy of the same thing.

Despite the advantages of email communication, participants felt that it was not the ideal media for the transfer of tacit knowledge. Email was not very personal, and there was no caring and emotions visible to the participants. Sue's concern was more around the timeliness of receiving feedback. She believed that because most people are bombarded with email they need to prioritise their feedback based on urgency, which might create delays for some of the conversations.

Compared to face-to-face communication email has a limited capability to deliver rich information, which could lead to misunderstanding or misinterpretation of delivered message. As May said:

Not to say that face-to-face discussion can't be supplemented by email or electronic chat or other forms but in those forms you miss a huge amount of additional signals that can lead to things getting off track and misinterpreted very easily.

Catherine had such an experience when she was making a joke to one of her colleagues in an email. That colleague misinterpreted it and thought she was angry. She suggested that a text message may be interpreted differently depending on the context, and when using email communication attitudes and emotions were detached from the messages, which could lead to misinterpretation of a message.

6.4.3 The use of multiple media

Several participants mentioned that they used a mix of both synchronous media and asynchronous media for the discussion of policy related issues with their colleagues.

Mark usually sent a precis of the face-to-face discussion via email to ensure that everyone was clear about the outcome of the discussion. He believed that the use of multiple media made the discussion more efficient. Catherine felt that sending documents via email to support face-to-face discussions was more productive and efficient than relying solely on one single means of communication, because email transmitted information efficiently, and face-to-face discussion gave people opportunity to explore ideas and thoughts. She said:

When sending emails, people can show me particular things, documents or diagrams, we can discuss actual examples… [When communicating face-to-face] we have an opportunity to discuss it together so we get to hear a variety of questions about things. I wouldn't want things just sent around email and told what to do; I wouldn't have the opportunity to discuss and hear about what people thought.

6.5 Personal relationship affects communication media use

People's choice of communication media was often dependant on the state of personal relationship between each other. Sam felt that it was necessary to meet the colleagues in person when working in a new group, and after he knew who they

were and how they worked, he would rely on other communication media such as video conferences, phone, and emails. Similarly, Mark believed that personal relationships had a great impact on the efficiency of the communication. He said:

> *If you have history with them, you know them, and you know probably what their perspective is likely to be, then I suppose you can go straight to the point, you can get things done more quickly. If you don't know them very well, it's much harder. You need some time figuring out what kind of person they are, and how they are going to respond you, and what their perspectives are, all that sort of thing. I guess if it's the first time you work with someone, it's better to see them in person, you know, get to know who they are and how they do things.*

6.6 Success factors in the implementation of policy

Participants commented on how the organisation could facilitate the interpretation and implementation of policies. Sue stressed the importance of communication during the policy implementation process. She also believed that having employees understanding the objectives of the policy, and having them contribute to the shape of the policy would facilitate policy implementation. Similarly, Mark believed that being involved in the policy making process could help people understand the intention of the policy. He suggested that "*whether or not you had input into the documents*" would significantly affect the interpretation and implementation of a policy. May also had such experience in a recent policy related activity. She stated:

> *When people are directly involved in establishing and implementing the process, there is a general understanding from everyone of what is expected… Having contribution for the organisation and to the development of the policy, so there is understanding at that level.*

Participants also considered consultation and clarification from the policy makers or from the superiors could help them to interpret and implement the policy correctly. Catherine said that when she has problems understanding a policy, she would go to the person who made the policy for clarification and explanation. When commenting

on the open-questions in the survey, a participant described having consultation available during the process as “helpful” and “assuring”, and it contributed significantly to the success of policy implementation. May believed that feedback on policy related questions with a link to the actually policy would help people to understand the policy as well as further implement the policy.

In summary, participants believed that the knowledge about the policy could be learnt through communication and consultation, and the involvement in the policy making process. Proper feedback would also help to understand the policy and further support them in interpretation and implementation of the policy.

6.7 Summary

This chapter presents the participants’ view about policy, the interpretation and implementation of policies, the role of relationships, and their media use during discussion about policy. Participants agreed that knowledge about interpreting and implementing policy was context specific and tacit, and was received mainly from communicating with experienced colleagues. Strong personal relationships between participants and their colleagues promoted the transfer of policy related knowledge between them. They believed that face-to-face communications were more appropriate for the transfer of policy related knowledge than email communication, and the state of the relationship between them and their colleagues would affect their choice of communication media.

CHAPTER 7. DISCUSSION AND IMPLICATIONS

7.1 Introduction

This chapter discusses the main findings of this research by integrating the quantitative results with the qualitative results. The contribution of this study is highlighted in the view of the contribution to theory and of the implication to practice. The limitations and implications for further research are discussed, followed by a conclusion for the whole thesis.

7.2 Discussion of the results

The research question addressed in this study (initially introduced in section xxx) was as follows.

> *Is the effect of the relationship strength between individuals on the success of tacit knowledge transfer stronger when people use asynchronous media than when people use synchronous media? What are the underlying mechanisms?*

This section describes how the research findings of this study answered the research question.

7.2.1 The effect of relationship strength on tacit knowledge transfer

The findings of this study suggested that Relationship Strength should be treated as a multi-dimensional construct consisting of closeness and trust. Thus the results of the study suggest that in the context of communication for tacit knowledge transfer, individuals may be close, but not trust each other, and vice versa. Correspondingly, the results are discussed in terms of the effects of closeness and trust as separate constructs, rather than in terms of relationship strength.

7.2.1.1 The effect of closeness

It was found that closeness positively affected tacit knowledge transfer success with a medium effect size (β= .407) for the group in which participants used only

synchronous media, and with a large effect size (β= .620) for the group in which participants used both synchronous media and asynchronous media.

Qualitative analysis suggested that close relationships between individuals allowed them to have a relaxed and warm interaction, enabling them to ask in-depth questions and explore more complex and sometimes difficult or controversial ideas. When they were close to each other they had already established common understandings, which made the communication more rich, and allowed the exchange of feelings and emotions, thus enabling the transfer of tacit knowledge. This was consistent to Hasty et al. (2006) and Hansen (1999), even though Hansen (1999) did not specifically use the term tacit knowledge.

7.2.1.2 The effect of trust

Whereas the quantitative analysis did not find statistical significance for the relationships between trust and tacit knowledge transfer success (β= .021 for group 1, β= .214 for group 2), the qualitative analysis suggested that with a high level of trust, the communication between individuals would be more honest and relaxed; therefore individuals are more willing to share their tacit knowledge. The ambiguous result for the effect of trust was surprising taking into account the context of the study because discussions of how to interpret organisational policies often involve individuals' attitude and perceptions toward the policies, therefore are likely to be highly sensitive.

The quantitative result is inconsistent with prior studies as well as the qualitative results. The reasons behind the inconsistency may be as follows. First of all, this study only measured the level of trust of the knowledge recipient, and not the knowledge provider, which is one-way rather than bi-directional. It was possible that the participants' and their colleagues did not share the same level of trust. For example, whereas the participant trusts the colleague, the colleague might not trust the participant to the same extent. The colleague may that fear the participant is engaging in opportunistic behaviours, such as using the knowledge gained to

pressure the colleague at a later date, or, simply, not respecting the colleague's privacy and passing on the colleague's perspectives to others (who may engage in opportunistic behaviour).

Secondly, trust refers to an individual's beliefs towards others' ability, integrity, as well as the individuals' benevolence. It is possible that the conceptualisation of trust used in this study was too broad. The measures in this study covered multiple aspects of the concept of trust, and these aspects may affect tacit knowledge transfer success differently. It is possible that a more focused conceptualization would be more appropriate. Prior studies found that whereas higher levels of ability-based trust and integrity-based trust lead to better outcomes for tacit knowledge transfer. The effect of benevolence-based trust was not significant (Levin & Cross, 2004; Muthusamy & White, 2005).

7.2.2 Interaction between media use and relationship strength

The quantitative result demonstrated that the effect of closeness on tacit knowledge transfer was stronger for the group in which participants used both synchronous and asynchronous media than it was for the group in which participants used only synchronous media. The results suggest that when individuals are unfamiliar with each other, the choice of media (synchronous versus a mix of both, in the sense of the terms as suggested by MST, see section 2.5.2) makes a lot of difference. In particular, individuals who are not close to each other are disadvantaged. However, for individuals who are close to each other, the difference between the ability of synchronous and asynchronous media to support tacit knowledge transfer is less pronounced.

Qualitative data suggested that when individuals communicate face-to-face, complex messages can be delivered and interpreted very quickly as they are delivered through natural communication cues, enabling the individuals to achieve empathy and understanding of common context leading to tacit knowledge transfer. However when messages are delivered through unnatural communication cues, the ability of

the messages to convey attitudes, emotions, and complexities of social context is influenced by whether there is a common understanding between individuals as well as how familiar they are with each other's communication style. It was also found that individuals tend to use synchronous media such as face-to-face communication and video conferencing when they collaborate with colleagues for the first time, and then they would switch to asynchronous media such as email over time. These results are consistent with DeLuca and Valacich (2006), and Liukkunen (2012).

7.2.3 Further insights

Descriptive quantitative data obtained in the survey and the qualitative data obtained via open-ended questions in the survey and via interviews allowed insights into the context and into the mechanism of tacit knowledge transfer that go beyond addressing the research model.

7.2.3.1 The pattern of communication media use

The qualitative results suggested that participants preferred to use the media that they felt produced the best results for a particular communication task. However the choice of media was often affected by differences in time and location between them and their communication partners.

Both quantitative and qualitative data showed synchronous media was the first choice for discussion, among which face-to-face communication was the most frequently used. This is consistent with prior studies such as Jasimuddin (2007) and Hasty et al. (2006), suggesting that face-to-face communication is the most efficient and the most commonly used media for transferring tacit knowledge.

Findings from qualitative analysis suggested that face-to-face communications enables fast interaction and the use of multiple cues with a high level of naturalness, its ability to support in-depth discussions and get immediate feedback facilitated tacit knowledge transfer. Voice intonation and body language enabled the delivery of rich and complex information, and allowed individuals to emphasise or clarify

certain points. Personal relationships were able to be developed more quickly in a face-to-face interaction.

Consistent with Dennis et al. (2008) and Kock (2004), the results demonstrated that face-to-face supports convergence by enabling fast interaction, which allows people to establish common understanding very quickly, and enabled messages to be delivered through communication cues with high level of naturalness such as body language, which can be processed efficiently.

Similar to Jasimuddin (2007), qualitative analysis showed that the major obstacles of face-to-face communication were time and distance. It is common for a group of people collaborating across distance and time zones, which make face-to-face communication impossible. In addition, qualitative results suggested that the lack of ability to record the communication in order to reprocess the messages was also one of the disadvantages of face-to-face communication.

Video conferencing can be an effective substitution for face-to-face communication because of its ability to show body language and other natural cues. However, although participants considered it as an effective communication media, as the quantitative result demonstrated, it was rarely used.

Although email was widely used, participants considered it as not appropriate for tacit knowledge transfer. Messages delivered through email communication were of a low level of naturalness; more cognitive effort was required to accurately interpret meaning. Furthermore, communication cues enabled by email communication have limited capability to deliver rich information; the meaning of the message often disconnected with the context, and therefore created barriers for tacit knowledge transfer. This was consistent with prior studies such as Murray and Peyrefitte (2007) and Hasty et al. (2006).

A mix of synchronous and asynchronous communication media was widely used. It was common for individuals to send emails in order to organise a face-to-face or

phone discussion, to transmit a document to support the discussion, or to send a transcript of the discussion. The use of both synchronous and asynchronous media made the discussion more efficient.

7.2.3.2 The tacitness of policy related knowledge

Although the nature of policy and how individuals interpret and implement policy was not a major purpose of this study, this study collected and analysed qualitative data about the participants' understanding of policy and what they do when they have to interpret and implement a policy.

The qualitative results suggested that although policy impacts on the individual in every aspect, it is broad and vague. A policy does not provide a step-by-step guide of what to do, but rather describes what outcomes are expected. The result demonstrated a high level of consistency with prior studies, which define policy as a guide that directs decision making, but leaves the interpretation to the decision makers (Robbins & Coulter, 2007).

The qualitative result demonstrated that individuals have been experiencing disconnections between a policy and the situation, disagreement between them and the people who made the policy, as well as conflicts between policies. As a result, individuals need to employ their tacit knowledge to interpret and implement the policy.

Also, the results indicated that a policy would often have different interpretations, in which case individuals had to consider other factors and then make decisions based on their prior knowledge about the policy. This was generally agreeing with Yanow (1996), who argues that the meaning of a policy is delivered to individuals through symbols, which could be in the form of language, objects, or acts. Those symbols are open to multiple interpretations to different audiences. Individuals' background, education level, position, as well as the context in which the policy is implemented,

have significant influences on their understanding of the meaning and the intent of the policy (see discussions in section 2.3.4.1).

The qualitative results demonstrated the importance of individuals' prior knowledge in the interpretation and implementation of policy. The results indicated that this might be because they often do not know the existence of policies addressing the problem, or even when they know the policy, it is difficult to find the policy document. When a problem arises, individuals tend to follow the convention established by senior staff members rather than look at the actual policy; and sometimes they rely on their own personal judgement to make decisions. Under such circumstances, individuals are forced to rely on their prior knowledge about the policy and about the situation to make decisions. Even when individuals know the policy and fully understand the policy, they sometimes make decisions that were different to the policy's intention in certain situations. This was consistent with studies by Spillane et al. (2002), that people make sense of a policy employing their prior knowledge, values, and beliefs to fit the situation.

Results indicated that when individuals have problems around policy or when they have difficulties interpreting and implementing a policy, they tend to seek help from experienced colleagues. It was highlighted that the knowledge about interpreting and implementing policy was highly tacit, because they learnt from colleagues' experiences, and through that learning process, they learnt things they had not been aware of without the interactions with their colleagues.

7.3 Contributions of the study

7.3.1 Contributions to theory

This section discusses the contribution of this study to theory, including contributions to Media Synchronicity Theory, to theories about knowledge creation and transfer, as well as to the mechanisms behind the change of individuals' media choice over time.

7.3.1.1 Implication for MST

This study found support for, and extended the implication of, MST in the field of tacit knowledge transfer. Based on the synthesis of prior literature, a model including communications media, personal relationship factors, and tacit knowledge transfer success was formulated. The model extended similar models addressing personal relationships and knowledge transfer such as Hansen (1999) and Levin and Cross (2004) by introducing media choice as a moderator. Although not covering all the aspects of MST (only included personal relationships as a part of the communication context), this model captured the core concept of it. Although there are a number of studies addressing MST and its implication on knowledge transfer (Dennis et al., 1998; Jasimuddin, 2007; Scott, 2008), this study is the first one that specifically focuses on the transfer of tacit knowledge and included all the elements of MST in a single model.

7.3.1.2 Implications for knowledge creation and transfer

With regard to the creation and transfer of knowledge about interpreting and implementing policy, a contribution of this study is in explaining the importance of personal interaction. Prior studies on interpreting policy focused on how individuals make sense of a policy under a certain circumstance (Hier & Walby, 2013; Yanow, 1996), The meaning of a policy is delivered to individuals through symbols (Yanow, 1996), and these symbols could sometimes make sense to individuals by themselves without relating to the context (Driver, Asoko, Leach, Scott, & Mortimer, 1994). However the results of this study adopted a view that consistent with Nonaka and Takeuchi's (1995) SECI model of knowledge creation, that the meaning of the policy as well as that about how to interpret and implement such policy is constructed, validated, and communicated through interactions between individuals (Driver et al., 1994; Nonaka & Takeuchi, 1995). Therefore this study adds to the body of policy studies by exploring how the meaning of a policy and the knowledge related to the policy were constructed through interaction.

7.3.1.3 The change of individuals' media choice

This study also adds a new view about the mechanisms behind the change of individuals' media choice by looking beyond media characteristics. Consistent with prior studies addressing MRT, this study found that communications media differs in their capability for delivering rich information. While this study found overall support for MRT, that rich media such as face-to-face communication was more appropriate for the transfer of tacit knowledge than lean media such as email, it also found that media richness was not the only factor that influences individuals' media choice. Media choice may be influenced by the context of the communication (e.g.: personal relationships), which was consistent with Trevino et al. (1987).

Moreover, this study is consistent with the view of Nicotera (2009) that communication is a process of social relationship building. Individuals chose to use face-to-face communication because it allowed individuals to build personal relationships. Although asynchronous media such as email could also allow individuals to build relationships during long-lasting communication, the cost of time and efforts would be much greater. In the light of this view, this study suggests that when personal relationships are developed, individuals are likely to switch to asynchronous media due to the high cost of synchronous communication especially when they are geographically separated.

Communication Accommodation Theory (Giles, 2008) suggests that individuals adjust their communication patterns to be more suitable for each other. In the light of this view, this study found that beside the development of common understanding (Carlson & Zmud, 1999; Kock, 2004) , individuals were able to become familiar with each other's communication style during frequent interaction and further adjust their own communication style to be more suitable for their counterparts. Therefore, over time the communications media can be used more efficiently and synchronous media become less needed.

7.3.2 Significance for practice

The results of this study will enable managers to assess the information systems by comparing the communications media employed in the organisation with the requirements of the communication tasks. Furthermore, although it was not the main purpose of this study, the results will enable managers to facilitate the interpretation and implementation of policies in the organisation.

7.3.2.1 Implication for managers

The results of this study will enable managers to improve the efficiency of an organisational information system by matching the choices of communication media with the underlying communication requirements of the tasks. This study demonstrated the communications media have different capabilities to deliverrich information and to support synchronous communication. When transferring tacit knowledge is the goal, the performance is likely to be maximised when using synchronous media such as face-to-face and video-conference.

This study also found that the choice of communications media changes as personal relationships develop. A strong personal relationship improves the efficiency of communication and enables the transfer of tacit knowledge especially when the use of synchronous media is constrained. The benefit of strong personal relationships should be considered when managing a group.

The results of this study will enable managers to improve the interpretation and implementation of policies within an organisation. It is important to develop an effective information system that allows the policy document to be found easily, and provide convenient consultation and clarification to employees when needed. It is also helpful to include employees in the policy making process and encourage employees to communicate and discuss policy.

7.3.2.2 Implication for individuals

The results of this study may allow individuals to chooce appropriate communication to match the requirement of a communication task and thus to maximise the

performance. The strength of personal relationships has implications for individuals when transferring tacit knowledge. A close personal relationship helps individuals to identify the source of required knowledge, and then to enable the transfer of such knowledge.

7.3.3 Contributions to methodology

This study employed a mixed research method consisting of a survey and interviews in the context of studying knowledge transfer. Studies involving MST use either only quantitative (Hasty et al., 2006; Joia & Lemos, 2010; Murray & Peyrefitte, 2007; Sarker et al., 2010; Scott, 2008) or qualitative method (Casal & Fontela, 2007; Jasimuddin, 2007; Sheng et al., 2013). This study combined quantitative and qualitative research methods that explored beyond the research model and gained deeper understandings about the reasons of media choice, the role of personal relationships, and the mechanism of tacit knowledge transfer.

7.3.4 Directions for future research

This section discusses the directions for future research

7.3.4.1 Conceptualisation of synchronicity

In this study, communications media were simply categorised either by synchronous or asynchronous. However, as Dennis et al. (Dennis et al., 2008) stated, the level of synchronicity varies between different media and even when using the same media differently. The level of synchronicity is dependant on how the five media capabilities (describing figure is presented in section 2.5.2.3) were used by individuals. Therefore in future research, synchronicity can be treated as a second order model with the perceived use of media capabilities as indicators.

7.3.4.2 Conceptualisation of trust

In this study, no statistical significance was found for the effect of trust on tacit knowledge transfer success. It was likely caused by the poor conceptualisation and measurement instrument of this construct. In future research, it is desirable to have a more focused conceptualisation of trust or to treat trust as a multidimensional

construct and test each aspect of it (e.g.: benevolence-based trust and integrity-based trust) separately in the model of this study.

7.4 Limitation of this study

This section discusses the limitation of this study.

7.4.1 Population

In this study, data were collected from university teachers in the discipline of human health and medicine. The population was justified because they often engage in tacit knowledge transfer activities and use a variety of communications media during the interaction. However, the research result would be strengthened if the data were collected from multiple populations, or through multiple sources (use organisational documents in addition to survey data). Additionally, the use of multiple populations and multiple data sources would make stronger claims regarding the generalizability of the quantitative results of this study.

In further research, it would be desirable that the findings of this study are validated in other populations with data collected using multiple methods.

7.4.2 Relied on university website

The contact details of the participants were collected from university websites, the participants' roles in their organisations were judged based on their position or job description stated on the website. Some of the information may have been outdated or incorrect. As a result, it was possible that individuals who were not university teachers were also invited to participate in this study. Although steps were taken to prevent this, for example, a description of the intended participants was clearly stated on both the invitation email and the information sheet, it was possible that individuals who did not fit the criteria participated in the study.

It is desirable that in further research, contact details are verified to be accurate and up-to-date.

7.4.3 Self-report questionnaire

In this study, quantitative data were collected from a self-report questionnaire that measures of independent variables and dependent variables from the same respondent. Although Harman's single factor tests did not find evidence of a common variable, common method bias may not have been completely absent.

It is desirable that in further research, steps are taken to further reduce the possibility of common method variance.

7.4.4 Small size of datasets and low response rate

In this study, the response rate was 13.8% with 221 usable responses. The group separation resulted in two datasets with sample sizes of 128 and 79 respectively. The relatively small sample size limited options for statistical analysis, and as the participants were all self-selected to participate in the study, the scores of the survey items may have been biased.

It is desirable that in further research, a larger response rate and larger datasets are obtained.

7.5 Conclusion

This study explored the interaction of media choice (synchronous media and asynchronous media) and relationship strength (closeness and trust between individuals) effects on tacit knowledge transfer success. The research model was developed based on two theoretical foundations, communication theories (primarily Media Synchronicity Theory), and tacit knowledge transfer theories. The research model was tested against quantitative data collected in a survey of university teachers in New Zealand. Qualitative data were collected via interviews and open-ended questions, and in-depth analysis and interpretation of these data were carried out to explore the mechanisms behind the research hypotheses that were found to be significant.

It was found that synchronous media such as face-to-face were the first choice and were the most appropriate for tacit knowledge transfer. It was also found that the concept of relationship strength is comprised of two distinct dimensions, closeness and trust. While closeness was found to affect tacit knowledge transfer success, the strength of the effect was influenced by media choice. The effect of trust was found not significant; however, it might be caused by the conceptualisation of the construct.

By testing the implication of Media Synchronicity Theory in tacit knowledge transfer settings, this study contributes to both knowledge transfer studies and studies on communication media.

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APPENDICES

Appendix A. Survey questionnaire

A Communication and Organisational Policy Survey

Preamble

Consider the last time you discussed with one of your colleagues (another employee working at the same organization) how one of the written policies at your organisation should be interpreted in your particular circumstances.

By a written policy we mean a document describing how you are expected to behave at your organisation, such as how you are expected to assess students' work, or use computers, or take a leave of absence, or similar. Such a document may or may not be explicitly described as a "policy" (e.g., it could be described as "rules" or "regulations") and may be issued at any level at the organisation (e.g., by the top management for the whole organisation or locally, by your department or division).

You may have discussed the policy with the colleague face-to-face, by email, over the phone, or by other means, and the discussion may have involved a series of messages, conversations, meetings, or chance encounters. Please, characterize the discussion by answering the following questions.

Section A: Understanding the Policy

This section focuses on how the discussion influenced your understanding of the policy and your ability to act on the policy.

Please answer the following questions by ticking the boxes that most accurately represent your views.

A01. The discussion improved my understanding of the meaning of the policy

Strongly disagree										Strongly agree
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

A02. The discussion improved my understanding of the intent of the policy

Strongly disagree										Strongly agree
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

A03. The discussion increased my knowledge of the content of the documents describing the policy

Strongly disagree										Strongly agree
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

A04. The discussion improved my ability to access the documents describing the policy

Strongly disagree										Strongly agree
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

A05. The discussion increased my understanding of how the policy relates to other policies at my organisation

Strongly disagree										Strongly agree
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

A06. The discussion increased my ability to ask penetrating questions about the policy

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

A07. The discussion increased my ability to create my own documentation based on the policy (such as study guides, marking schedules, job descriptions etc.)

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

A08. The discussion improved my ability to take the policy into account when making decisions

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

A09. The discussion improved my ability to make suggestions regarding policy development at my organisation

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

A10. I learned from the discussion more than I initially expected

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

A11. The discussion took more effort than I initially expected

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

A12. The discussion took more time than I initially expected

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

Please comment further on how the discussion affected your understanding of the policy and your ability to act based on the policy

Section B: Synchronous Communication

Did the discussion involve face to face conversations (formal or informal), conversations over the phone, using video conferencing software, or other synchronous communication (so that your colleague can react to your statement as you are making it, such as by interrupting you)?

◯ Yes (continue answering this section) ◯ No (Go to section C)

Please answer the following questions by ticking the boxes that most accurately represent your views.

B01. We discussed face to face during chance encounters

Not at all										A lot
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

B02. We discussed face to face at formal meetings

Not at all										A lot
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

B03. We were drawing (on a whiteboard, on paper, etc.) to illustrate policy related insights during face to face discussions

Not at all										A lot
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

B04. We discussed using video-conferencing (e.g., Skype)

Not at all										A lot
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

B05. We discussed over the phone

Not at all — A lot

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

B06. We discussed using other synchronous communication media (please, specify)

B07. I provided immediate feedback to the colleague's statements or suggestions

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

B08. The colleague provided immediate feedback to my statements and suggestions

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

B09. The discussion proceeded very quickly

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

B10. I used gestures to express my attitude to policy related issues

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

B11. I used voice intonation to express my attitude to policy related issues

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

B12. I relied on body posture to express my attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B13. I used facial expressions to express my attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B14. My colleague used gestures to express attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B15. My colleague used voice intonation to express attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B16. My colleague relied on body posture to express attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B17. My colleague used facial expressions to express attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B18. In the discussion, I carefully planned my verbal statements in advance

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

B19. I frequently interrupted the discussion to look up saved messages (e.g. emails) relevant to the discussion

Strongly disagree										Strongly agree
○	○	○	○	○	○	○	○	○	○	○

B20. My colleague frequently interrupted the discussion to look up saved messages (e.g. emails) relevant to the discussion

Strongly disagree										Strongly agree
○	○	○	○	○	○	○	○	○	○	○

Please comment further on your choice of synchronous media and on how you used the media

Section C: Asynchronous Communication

Did the discussion involve sending emails, instant messages, voice mail, posting at blogs, discussion forums, or social media sites (such as Facebook or LinkedIn), or other asynchronous communication (so that you cannot see or hear the colleague's reaction as you are writing a message)?

◯ Yes (continue answering this section) ◯ No (Go to section D)

Please answer the following questions by ticking the boxes that most accurately represent your views.

C01. We discussed using e-mail

Not at all ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ A lot

C02. We discussed using instant text messaging (e.g., TXT on a mobile phone, MSN messenger on a personal computer, or similar)

Not at all ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ A lot

C03. We discussed by posting blog posts

Not at all ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ A lot

C04. We discussed over a discussion forum

Not at all ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ A lot

C05. We discussed by posting on social media sites (Facebook, LinkedIn, or similar)

Not at all — A lot

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

C06. We discussed by leaving voice mail messages

Not at all — A lot

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

C07. We discussed by leaving messages on a shared white board

Not at all — A lot

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

C08. We discussed by exchanging notes written on paper

Not at all — A lot

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

C09. We discussed using other media (please, specify)

C10. In my messages, I provided immediate feedback to the colleague's statements or suggestions

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

C11. In the colleague's messages, the colleague provided immediate feedback to my statements and suggestions

Strongly disagree — Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

C12. The exchange of messages proceeded very quickly

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

C13. In my messages, I relied on emoticons (such as :) or :() or on other means (such as voice intonation in voice mail)) to express my attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

C14. In the colleague's messages, the colleague relied on emoticons (such as :) or :() or on other means (such as voice intonation in voice mail)) to express attitude to policy related issues

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

C15. In the discussion, I relied on text appearance (e.g. using capital letters, different fonts, or different text layouts) to convey information

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

C16. In the discussion, the colleague relied on text appearance (e.g. using capital letters, different fonts, or different text layouts) to convey information

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

C17. In the discussion, I spent a lot of time to edit messages before sending them

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

C18. In the discussion, I formulated my suggestions, questions, and comments with a lot of care (e.g., edited email messages multiple times before sending)

Strongly disagree										Strongly agree
○	○	○	○	○	○	○	○	○	○	○

C19. The media allow me and my colleague to save messages (if yes, answer C20)

Yes (Answer question C20)	NO
○	○

C20. I spent a lot of time examining saved messages during the discussion

Strongly disagree										Strongly agree
○	○	○	○	○	○	○	○	○	○	○

Please comment further on your choice of asynchronous media and on how you used the media

Section D: Trust between You and the Colleague

This section focuses on how well you know the colleague and how close you are. Please answer the following questions by ticking the boxes that most accurately represent your views.

D01. I feel comfortable using informal language with the colleague

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

D02. I feel comfortable discussing personal issues with the colleague

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

D03. I feel comfortable discussing private issues with the colleague

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

D04. I feel comfortable communicating with the colleague

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

D05. I feel close to the colleague

Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

D06. I feel I know the colleague well

Strongly Strongly

disagree agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

D07. If I required help, the colleague would help me

Strongly disagree Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

D08. The colleague knows my organisation's policies very well

Strongly disagree Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

D09. The colleague has good judgment in interpreting my organisation's policies

Strongly disagree Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

D10. I can always rely on the colleague for help with problems around my organisation's policy

Strongly disagree Strongly agree

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

Please comment further on your answers in this section

Section E: Demographic Information about You and Your Organisation

E01. How many years have you been working in your organisation?

E02. How many years have you been working in your organisation's industry?

E03. What is your role in your organisation?

E04. How long have you been working in your present role?

E05. How many years of total work experience do you have?

E06. What is your highest educational achievement?

- ◯ Secondary School
- ◯ Bachelors
- ◯ Masters
- ◯ Doctorate

Other, please specify _____

E07. What is your gender?

- ◯ Male
- ◯ Female

E08. Your age

- ◯ Under 36
- ◯ 36 - 40
- ◯ 41 - 45
- ◯ 46 - 50
- ◯ 51 - 55
- ◯ 56 - 60
- ◯ 61 - 65
- ◯ Over 66

Would you like to participate in a follow-up interview? If yes, please enter your contact details below.

Email: _____

Phone: _____

Would you like to receive a summary of survey results along with an outline of the literature on which the survey questions are based?

◯ Yes, please enter your email address below ◯ No

_____

Your comments about your answers in this section (if any)

Your comments about the survey overall (if any)

Thank you very much for your time and commitment

Appendix B. Invitation Letter

Dear <title>,

I am a master's student in the School of Management at Massey University, Palmerston North. As part of my master's project I intend to use a survey to explore how employees discuss the meanings of organizational policies (formal written rules that organizations expect their employees to follow, such as rules on how to assess student work, rules for taking leave and so on). My survey instrument is based on a comprehensive review of literature devoted to organizational policy interpretation and to the effectiveness of electronic media. The instrument has been validated in two pilot studies.

You are identified as a university teacher in New Zealand, I would like to invite you to participate in the survey, which will take approximately nine minutes of your time. As a participant, you will have access to a summary of survey results along with an outline of the literature on which the survey questions are based.

I am confident that you will find the survey questions very informative. Completing the survey will offer you an opportunity to reflect on how employees in positions similar to yours interpret and make sense of the formal written rules they are supposed to follow.

The survey is anonymous—the software used to conduct the survey and the survey procedures ensure that neither your identity nor the identity of your organization is recorded.

To access the survey questions online, please Click Here. If the link does not work in your environment, you can copy and paste the following URL into your browser: http://masseybusiness.eu.qualtrics.com/WRQualtricsSurveyEngine/?Q_SS=8GoJjKUx5p9OKs5_cSAfmmQKu7ZckAd&_=1

Alternatively, if you prefer to work with a hard copy of the survey, please let me know and I'll post you the necessary forms by regular mail.

For further details about the survey, scroll down to view the information sheet. Your participation in this survey is entirely voluntary. By completing this survey you are giving your consent to be involved in the research.

If you would like to opt out of future emails, please click here to opt out

Thank you for considering this invitation. I look forward to hearing from you.

Yours Sincerely,

Jiatao Yu

PhD lab, BSCB 1.08
School of Management
PN241
Massey University
Private Bag 11222
Palmerston North, New Zealand

Office Phone: 64 6 3969099 85835
Mobile Phone: 02102323067
E-mail: J.Yu1@massey.ac.nz

Appendix C. Information Sheet

THE EFFECT OF MEDIA SYNCHRONICITY ON TACIT KNOWLEDGE TRANSFER SUCCESS

Dear respondent,

You are identified as a university teacher in New Zealand, you are invited to participate in the survey I am conducting as part of the fulfilment of the requirements for the Degree of Master in Information Systems at Massey University. You are under no obligation to accept this invitation. However, your contribution will be valuable and much appreciated.

Researcher Introduction

I am Jiatao Yu, and I am currently pursuing a master's degree at Massey University, Palmerston North, New Zealand. My supervisors are Dr Keri Logan and Dr Alexei Tretiakov, and my area of interest is communication patterns and their influence on tacit knowledge transfer at organisations. Tacit knowledge is knowledge that is not captured in documents, and I am focusing on a particular type of tacit knowledge—knowledge about organizational policies.

Project Description and Invitation

The purpose of this study is to investigate the influence of media synchronicity (patterns of media use in communication) on tacit knowledge transfer success, in the context of transferring knowledge about organizational policies. The finding of this study will benefit both researchers and practitioners in the field of Management Information Systems, Communication, and Knowledge Management. Your input and feedback are very important to ensure the success of this study.

Participant Identification and Recruitment

Your name and address have been obtained from the publicly available website of your University.

Data Management

The survey is anonymous—your identity or the identity of your organization will not be recorded along with the information you provide at any stage of the process.

All information provided by you will be kept strictly confidential. It will be securely stored at Massey University and will only be viewed and used by myself and my supervisors for the purpose of data analysis. Your response will be aggregated with the responses of all other

participants to form overall results and no individual or organisation will be identifiable.

Participant's Rights

As a participant you will have the right to:

- decline to participate
- refuse to answer any particular question
- ask any questions about the study at any time during participation
- be given access to a summary of the findings of the study when it is concluded
- withdraw from the research project at any stage.

Committee approval statement

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by the University's Human Ethics Committees. The researchers named below are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researchers, please contact Professor John O'Neil, chair of the Human Ethics Chair's Committee, telephone 06 3505573, email humanethics@massey.ac.nz.

Project Procedure

If you are willing to participate in this study, I sincerely thank you. The estimated completion time for this questionnaire is an average of nine minutes. Please complete the survey online using the link provided at the beginning of this message.

Contacts

Please do not hesitate to contact me or my supervisors if you have any questions about this study.

My contact details are as follows.

Jiatao Yu
PhD lab, BSCB 1.08
School of Management
Massey University
Private Bag 11222
Palmerston North, New Zealand
Phone: 64 6 3569099 x 85835
Mobile Phone: 02102323067
E-mail: J.Yu1@massey.ac.nz

Alternatively, you can contact one of my supervisors:

Dr Keri Logan
School of Management
Massey University
Private Box 756
Wellington, New Zealand
E-mail: K.A.Logan@massey.ac.nz

Dr Alexei Tretiakov
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Massey University
Private Bag 11222
Palmerston North
E-mail: A.Tretiakov@massey.ac.nz

Appendix D. Reminder Letters

First reminder letter (online)

Dear <title>,

You may recall receiving an email a few days ago inviting you to take part in a survey on the subject of communications and policy studies. Your help with this survey is important as the information you provide will help me answer the research question. At the time of sending this email, I have not received your response. If you already completed your questionnaire, please accept my appreciation for your time and participation in the research.

However, if you have not yet completed the questionnaire, I would be grateful if you could do so by Clicking Here, if the link does not work in your environment, you can copy and paste the following URL into your browser:

http://masseybusiness.eu.qualtrics.com/WRQualtricsSurveyEngine/?Q_SS=8G

As mentioned in my previous email, your answers will be completely confidential, neither your name nor your organisation's name will be associated with the answer.

If you are not willing to participate in this survey or you are not the right person, you can Opt Out from future emails.

Thank you in advance for your time and your commitment.

Yours sincerely,

Jiatao Yu

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Second reminder letter (postal)

Dear <title>,

You may recall receiving an email last December inviting you to take part in a survey on the subject of communications and policy studies. Your help with this survey is important as the information you provide will help me answer the research question. At the time of sending this email, I have not received your response. If you already completed your questionnaire, please accept my appreciation for your time and participation in the research.

However, if you have not yet completed the questionnaire, I would be grateful if you could do so by fill out the questionnaire and send it back with the prepaid envelope. If you would like to complete it online, you can type following URL into your browser.

http://goo.gl/XkBFGA

As mentioned in my previous email, your answers will be completely confidential, neither your name nor your organisation's name will be associated with the answer.

For more information about the research, please see the information sheet.

Thank you in advance for your time and your commitment.

Yours Sincerely,

Jiatao Yu

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Appendix E. Interview Invitation Letter

Dear <title>,

You may recall that you completed a survey on the subject of organisational policy and communications several weeks ago. I would like to thank you for your contribution to this study.

In the survey answers you indicated that you would be willing to participate in a follow-up interview. The purpose of this interview is to gain a deeper understanding of how you interpret organisational policy, and how you discuss policy with your colleagues. It is partly up to you how long the interview will be, but probably about half an hour.

By taking part in this interview you are giving your consent to be involved in the research.

The data from this interview will be treated as confidential. It will be aggregated and presented so that individuals and organisations cannot be identified. A transcript of the interview will be sent to you for your comments and corrections prior to its analysis. You may withdraw yourself or any information you have provided from this project before data collection is completed, without having to give reasons and without penalty of any sort.

Please let me know if you are still willing to participate in the interview and your availability in the next few weeks. I will then set up the interview at your convenience.

I appreciate that you are busy and so I thank you in advance for your commitment and your time.

Yours sincerely

Jiatao Yu

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Appendix F. Acknowledgement of the Low Risk Notification

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

15 May 2013

Jiatao Yu
7 South Street
West End
PALMERSTON NORTH 4410

Dear Jiatao

Re: The Effect of ICT on Tacit Knowledge Transfer

Thank you for your Low Risk Notification which was received on 9 May 2013.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
Chair, Human Ethics Chairs' Committee and
Director (Research Ethics)

cc Dr Keri Logan
School of Management
Wellington

Prof Sarah Leberman, HoS
School of Management
PN214

Appendix G. An example of interview schedule

Introduction

Thank you very much for taking part in this research.

The data from this interview will be treated as confidential. In the account of this research, the data obtained in multiple interviewees at multiple organisations will be aggregated and presented in a way that individuals and organisations cannot be identified. Moreover, I will send you a transcript of the interview for your comments and corrections before I use the transcript in the research.

Do you give me permission to digitally record the interview? This is to ensure that I get all the details of our conversation. Of cause, during the interview, I will pause of stop recording if you request me to.

It is partly up to you how long the interview will be, but probably about half an hour. During the interview, you don't have to talk about anything you don't want to and you can end the interview at any point. You can interrupt me to ask for clarification or to voice your opinion about my questions.

Background questions

(Explore the role of discussions in transferring knowledge about organizational policies at the respondent's organization.)

1. In which ways does your work have to take into account organisational policies? (Probe: What kind of policies?)
2. Would you describe the problems you and your colleagues experience with interpreting the policies of your organization, if any? (Probes: How much this differs from policy to policy? Why?)
3. What do you do when you need to decide how to interpret a policy in particular circumstances? (Probe: Would you give some examples?)
4. In which ways discussions with your colleagues help you to decide how to interpret a policy in particular situations? (Probe: What kind of discussions? How do you choose the colleagues to discuss policy related issues?)
5. You have responded to my online survey. In your response, you indicated that a discussion with a colleague helped you to interpret a policy. In your view, why the

discussion was successful? (Probe: In which ways did your colleague's experience at your organization contribute to the success of the discussion?)

Key questions

Communication related

1. According to your answers to the survey, you had the discussion with your colleague using face-to-face communication. Why did you choose this media?
2. Comparing to other communication media such email, what were the advantages and disadvantages of using face-to-face communication when discussing the policy?
3. You and your colleague provided fast feedback to each other. How did this affect the discussion?
4. You used body language. How did this affect the discussion?
5. Your colleague used body language. How did this affect the discussion?

Personal relationship strength

6. According to your answers to the survey, you are close the colleague. How did this affect the discussion?
7. In which ways did the nature of your relationship with the colleague affect your choice of communication media?

Closing

1. In your opinion, how could your organization facilitate policy knowledge and interpretation?
2. Are there any further issues that you would like to discuss?
3. Whom else at your organisation should I interview?

Wrap up:

I will email you a transcript of this interview for your comments in two or three weeks.

Your feedback is very valuable for this study. Thank you very much for you time.