

**Causal Mechanisms of Technological Fit in a Knowledge Work
Environment**

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A thesis submitted to Auckland University of Technology in partial
fulfilment of the requirements for the degree of
Master of Business (MBus)

2016

Department of Business Information Systems

Abstract

This work provides an explanatory study focused on the workplace interaction that occurs among people, the tasks they perform and the suitability of the technologies they use to perform those tasks. The study is informed by a specific theoretical perspective – the Task-Technology Fit (TTF) model – to help understand these interactions. Additionally, the study concentrates on a particular organisational setting, a single office of a large multi-national insurance broking firm, which is represented throughout the study as a knowledge work environment. The objective of the study is to uncover causalities of technological fit. As a concept, fit describes the degree to which a technology or set of technologies align with the characteristics of a task or set of tasks and, as an academic topic, it is widely represented within Information Systems (IS) literature. However, few studies related to TTF theory have attempted to address or identify the fundamental causal conditions that give rise to fit. Using a critical realist perspective to underpin the research direction, thematic analysis was employed to identify technological fit causalities relative to the research context. Data were obtained from eight workplace participants using semi-structured interviews, which resulted in the identification of four causal themes. Of the themes identified, the findings indicated that technological fit occurs as a result of human capabilities. As a presence within a technological artefact, fit comes into existence as a creative and cognitive process, when designers, analysts or system architects fully understand, translate and render complex task requirements into a suitable technological representation. Organisational factors, such as firm structure and managerial support, and technical factors, such as the nature of the technology used to execute a task, influence the extent to which fit is represented within the technological artefact. Whilst specific to a particular organisational setting, the results of the research suggest that technological fit has a more dynamic and social aspect to it than many past studies indicate, an insight which may offer an alternative perspective on the TTF theoretical model to those involved in systems design, development and management as well as the wider academic community.

Keywords:

Critical realism, thematic analysis, Task-Technology Fit theory, causality, knowledge work, insurance.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed:

David G. Brown
2 March 2016

Acknowledgements

My heartfelt appreciation goes out to several people whose encouragement spurred me on to start this work and whose collective support enabled me to complete it.

Firstly, I would like to express my sincere gratitude to my research supervisor, Dr. Antonio Diaz Andrade, for his unfailing patience, motivation, and sound advice throughout this thesis-writing journey. His mentorship and encouragement not only provided practical guidance and direction for my research but also helped to refine, challenge and deepen my own thinking, revealing a world of new perspectives. I count it as a real and rare privilege to learn from someone of his standing.

I extend my warmest thanks to William (Bill) English, who painstakingly pored over my research, made corrections and offered generous, wise advice to improve the composition of my written work.

I also gratefully acknowledge my work colleagues for their participation in this research, as well as their ongoing encouragement and expressions of interest throughout. Their hard work, dedication and professionalism are a tribute to the industry and clients they faithfully represent. I would especially like to thank Peter Lowe and Brad Wren for supporting my foray into the world of academic research.

To my loving, gentle and supportive wife, Trecia, whose selflessness, patience and encouragement brought balance and perspective back to my life when the toil of writing and research became overwhelming. You have my love forever.

Finally, to my mother, Rowena, and in memory of my late father, Garth, both of whom instilled in me the importance of exploring knowledge, challenging established thinking and working hard to achieve my goals. I dedicate this work to you both in the spirit of respect, gratitude and love.

This study was approved by the Auckland University of Technology Ethics Committee (AUTEC) on 20 May 2015, AUTEC approval number 15/144.

Chapter 1 Introduction

*"It is unworthy of excellent men to lose hours like slaves in the labour of calculation
which could safely be relegated to anyone else if machines were used."*

Gottfried Wilhelm von Leibniz (1646 – 1716), inventor of the *staffelwalze* ("Stepped Reckoner"), a mechanical device used for arithmetic calculation

Evidence of early human existence reveals a close alignment between the use of rudimentary stone tools and human development. Over time, these Palaeolithic beginnings eventually lead to the development of basic mechanical devices and instruments for counting and keeping records, which evolved to form the foundation of present day information technologies. The relationship between people and tool use highlights a single and constant truth: humans design, develop and use devices to ease the burden of physical work and reduce the complexity of mental calculation. Information Systems (IS) literature has long explored, described and analysed the interaction between human activities and technologies, resulting in the development of numerous theories and models such as Socio-technical Theory (Cherns, 1976), Work Systems Theory (Bostrom & Heinen, 1977; Alter, 1999) and the Technology Acceptance Model (Davis, 1986) to help represent this relationship. This work aims to add to this on-going research effort, by providing an explanatory study that describes these socio-technical interactions.

We are all impacted by the influence of technology and many have experienced first-hand the extent of its rapid change and proliferation within their personal lives and working environments. Unquestionably, computer technology has given rise to a fundamental shift in workplace behaviour as well as the way work is performed. Within the financial services sector in particular, technological advancement has catalysed a vast array of customer-centric services and automation, ranging from on-line banking and share trading platforms to improved data sharing, business-to-business integration and the automation of various office processes. Exposure to this technological advancement has substantially transformed, disrupted and, in some cases, eradicated traditional business models. Against this backdrop of rapid technological change and disruption is the international insurance broking industry, which stands out as remaining relatively unchanged in the face of widespread technological upheaval. According to Gasc (2013), around 60% of insurance

companies lack a holistic digital transformation strategy, and only about 13% have a totally integrated digital platform. This observation also aligns with my own views, which are based on a career that spans over twenty years within the international insurance industry. Over this time, mainstream technologies have moved from the use of ‘dumb terminals’ and mainframe infrastructures to highly mobile, cloud-based solutions that interact with data using flexible services and open architectures. Yet, in spite of an unparalleled level of processing power, highly flexible enterprise architectures and a myriad of expert tools to underpin the development of well-designed software, the insurance industry, and specifically the insurance broking industry, has not appeared to move with the times. This is not to suggest that the insurance industry is Luddite, overly cautious or techno-phobic. Indeed, I know from my own experience that various insurance firms which represent the industry internationally have embarked on numerous and significant technological initiatives over the years, all with varying degrees of success. However, there remains an issue that is made manifest by an absence of a single, cohesive system that satisfactorily represents the complete insurance broking process (Marques, 2013). As it currently stands, the business of insurance broking is often enacted through a patchwork mix of non-integrated, and often rudimentary, tools. I am interested in uncovering the fundamental reasons that help explain the lack of technological advancement within the insurance broking sector. Does the issue stem from poor management, a lack of capital investment or a series of poor technical designs? Does the issue stem from an underlying characteristic particular to the business of insurance? Is it a cultural matter, the result of a conservative, traditional ‘old world’ leadership style or a failure to appreciate the value of information technology? Does the issue point to a deeper technological deficiency or inadequacy?

The Task-Technology Fit model is used as the theoretical lens to derive answers to these questions and offers itself as a potentially useful theory to approach the topic of technological alignment against a given set of task characteristics (Goodhue & Thompson, 1995). However, as a theory, Task-Technology Fit offers little in the way of deeper analysis relating to the central question this study seeks to address, which is stated as follows:

What are the fundamental mechanisms that cause fit to occur between tasks and technologies?

To help uncover so called ‘causal mechanisms’ of technological fit, I turn my attention to critical realism (Bhaskar, 1975). Within this perspective, I find a philosophy that largely aligns with my own take on reality as well as providing a rich source of related material that concerns itself with causally-based research.

Studies on Task-Technology Fit abound, with the vast majority of them concerned with deriving a measure of fit using deductive, quantitatively-based methods (Goodhue & Thompson, 1995; Goodhue, 1997; Zigurs & Buckland, 1998; Maruping & Agarwal, 2004; Staples & Seddon, 2004; Chang, 2008). According to Furneaux, (2012), few studies approach the topic using a more reflective, interpretivist stance. Fewer still attempt to uncover the underlying conditions or causal mechanisms that give rise to the existence of fit or misfit. The rarity of such research compels and justifies this particular study. Furthermore, and in spite of the specific organisational context this study concentrates on, it is hoped that the results of this research will appeal to a wide audience, especially to those involved in systems analysis, design and management.

In summary, this particular study seeks to add a fresh perspective to an established theoretical model and, in doing so, cast a little more light on some possible causalities of fit. The following paragraphs describe the layout of this thesis chapter by chapter.

Chapter Two - Literature Review

Chapter Two concentrates on the essential theoretical features of Task-Technology Fit, which includes a review of key studies and a summary of their empirical findings as well as the theory’s various conceptualisations. The chapter provides a broad theoretical grounding of each component of Task-Technology Fit – starting with a definition of fit, then moving to an overview of knowledge work in order to frame the research context, followed by a review of task theory and, finally, a definition of technology.

Chapter Three –Methodology

In Chapter Three, an outline of critical realism is introduced, with a view to position it as a philosophical perspective to help direct the research effort. The chapter then provides an overall research strategy, a methodological approach based on thematic analysis and critical realist principles, concluding with an outline of the methods used to collect data and conduct the analysis.

Chapter Four – Research Context

Chapter Four presents the organisational setting in which the research is conducted. The chapter commences with a review of the participating organisation's business model and the wider industry segment that it operates within. The main thrust of the chapter concentrates on the specific research context and explores the processes and tasks commonly associated with the underlying business, together with the technologies used to execute these processes and tasks.

Chapter Five – Analysis

Using knowledge worker roles as the main unit of analysis, selected participants are interviewed and their actions and reflections analysed. Coding methods are used to conduct the analysis in order to derive relevant causal themes related to technological fit and misfit.

Chapter Six – Discussion

Chapter Six takes the major causal themes suggested by the analysed data and compares these against established theory. The results are then discussed in the context of a retroductive analysis, in an effort to identify mechanisms that best explain fit causality, based on the study's analytical findings (Sayer, 1992).

Chapter Seven - Conclusions

The final chapter provides concluding remarks, which summarise the research accomplishments and the central findings of this study. The limitations of the study are highlighted together with proposed areas for future research and final comments.

Chapter 2 Literature Review

2.1 Task-Technology Fit – theories, concepts & models

As a theoretical model, Task-Technology Fit (TTF) explains the nexus between individual or group-based task requirements and the functionality of a technology designed to meet those requirements. It is “the degree to which a technology assists an individual in performing his or her portfolio of tasks” (Goodhue, 1997, p. 449). While this definition accurately conveys the general meaning of TTF theory, the literature indicates that a far wider and more varied interpretation of the theoretical model exists, which is examined in the following sections of this review. At the heart of the TTF model lies the notion of fit and this study seeks to reveal causalities of this phenomenon. To do so, it is necessary to uncover the inner-workings of the tasks and technologies associated with such fit. As such, this chapter looks at the nature of tasks and technologies separately as well as their collective presence within the TTF model. However, before delving further into the theoretical roots of TTF, an outline of the notion of fit itself is first required.

When used as an adjective in regular language, fit connotes the suitability, appropriateness or efficacy of an object. As a verb, it points to the moulding, shaping and conforming of an object’s properties. Both senses of the word apply equally well when used in the context of Task-Technology Fit theory, giving the term an extra depth of meaning. From an academic standpoint, the term fit derives from two main bodies of research. Within the strategic management literature, the term has its roots in contingency theory, which concerns itself with the interplay between environmental conditions, organisational structure and performance. Contingency theory maintains that there is no singular, optimal prescription for organisational structure, decision-making or leadership. Such optimisation is contingent upon various internal or external factors that may impose themselves on a particular organisation, including, but not limited to, its structural configuration (Mintzberg, 1979), task uncertainty (Perrow, 1967), strategy (Miles, Snow, Meyer & Coleman, 1978) and, of particular interest to this study, the influence of technologies (Woodward, 1958; Van de Ven & Drazin, 1984). Within the behavioural literature, Vessey (1991) uses the term ‘fit’ to highlight the interrelationship between how a problem is represented and the tasks involved in solving the problem. Vessey’s (1991) study claims that a poorly represented problem or an ill-conceived

solution add to an individuals' cognitive demands and thus undermine problem-solving performance. Based on Vessey's (1991) work, fit is presented in cognitive terms and can be summarised as the match between the task, the way in which information is presented and an individual's problem solving skills. Within the field of IS research, the idea that technological functionality needs to be well-suited to the task or tasks it was designed to address is not new. However, the emergence of TTF literature provided a theoretical model that exclusively concentrated on the relationship between tasks and technologies, with the first studies published during the mid-1990s (Goodhue 1995; Goodhue & Thompson, 1995).

To commence this literature review, the Business Information Systems directory of the ProQuest database was used to search all peer-reviewed articles that contained 'Task-Technology Fit' in the title. This query yielded 127 results and the subsequent examination of the literature itself revealed three aspects particular to the TTF model: its application within a wide array of research perspectives; the predominance of a mainly positivist research paradigm to articulate TTF theory and the use of various surrogate measures to assess the presence of fit. The following sections elaborate on these three aspects further.

2.1.1 A diversity of research perspectives

Past studies indicate that the TTF model is a multilevel theory that can be validly applied to individual (Goodhue & Thompson, 1995), group (Zigurs & Buckland, 1998) and organisational (Strong & Volkoff, 2010) units of analyses. Similarly, the literature indicates considerable variation in how theorists actually define the TTF model. For example, Fuller and Dennis (2009), quoting from the research derived by Goodhue (1995), frame the task and technology components in specific, singular terms and also identify an individual's competence in their definition of the TTF model, which is stated as: "the degree to which features of a technology match the requirements of the task and the abilities of the individuals performing it" (p. 3). Mathieson and Keil (1998) also define the task and technology components in singular terms but make no reference to individual capability or performance, with the TTF model stated as: "the extent to which a particular task can be performed effectively and efficiently with a particular technology" (p. 222). Various others describe the model in general terms, defined as the degree to which technology assists an individual in performing his or her portfolio of tasks (Chang, 2008; Goodhue, 1997; Maruping & Agarwal; 2004; Staples & Seddon,

2004). Dishaw and Strong (1998) define the TTF model as “the matching of the functional capability of available information technology with the activity demands of the task at hand” (p. 109). As a final example of these multiple TTF definitions, Pendharkar, Khosrowpour and Rodger (2001) and Jarupathirun (2007) introduce a component of user perception to their respective definitions of TTF, which Pendharkar et al. (2001) define as the “perceptions that the system capabilities match with the users’ task requirements” (p. 84).

These varied theoretical definitions are tied to how the term ‘fit’ is operationalised in a given study. Within the strategic management literature, Venkatraman (1989) offers six approaches to assess fit, namely fit as moderation, fit as mediation, fit as matching, fit as gestalt, fit as profile deviation and fit as co-variation. As such, Venkatraman (1989) presents fit as a largely measurable phenomenon framed within a generally positivist perspective. Conversely, and as indicated above in the study conducted by Pendharkar et al. (2001), fit may be directly assessed, expressed as a function of end-user perceptions of task requirements and of technological suitability. This definition of fit offers a more personal, descriptive and interpretivist perspective of fit.

As a final example of the fit definition, Strong and Volkoff (2010) provide a longitudinal study of an enterprise system implementation, using a critical realist perspective together with grounded theory techniques to frame their research. Here, Strong and Volkoff (2010) focus on the notion of ‘misfit’ and borrow from the work of Sia and Soh (2007) to expand this term to their particular research context. The underlying reason for this approach stems from the premise that an enterprise system represents a “packaged solution”, which Strong and Volkoff (2010) contend is generic and thus never able to completely meet the unique needs of individual organisations. That is, a packaged software deployment is assumed to introduce a degree of misfit into an organisation. Strong and Volkoff’s (2010) study highlights these misalignments through the implementation of a new enterprise system and outlines six domains of misfit: functionality, data, usability, roles, control, and culture. These domains were condensed into two classifications of misfit: misfit caused by deficiencies and misfit caused by system imposition. The authors then provided opposite, more fit-relevant terms to frame these classifications, which were “fit as coverage” (which indicates an absence of system deficiencies) and “fit as enablement” (which indicates an absence of system impositions). Fit, as it relates to Strong and Volkoff’s (2010) interpretation, is

regarded as a collective construct, comprising various underlying, interdependent entities that each operate at varying levels within an organisation. The fit construct employed by Strong and Volkoff (2010) requires researchers to regard fit within an organisational whole as well as applying it to each of the interactions that make up its constituent parts.

As a final example of the TTF model's diverse nature, the literature highlights that the original TTF model has been extended to incorporate different conceptual frameworks over time. Goodhue and Thompson (1995) adapted the basic TTF model to include a "utilisation stream". Borrowing from the work of Davis (1989) and Doll and Torkzadeh (1991), the utilisation stream is a construct that comprises user attitudes, beliefs and behaviours, which are regarded as key predictors of IS utilisation. The classical form of the TTF model is augmented by this construct and presented as the "Task-to-Performance Chain" model. Goodhue and Thompson's (1995) study was followed up by Dishaw and Strong (1999) who merged TTF with the Technology Acceptance Model (TAM). TAM is a well-established theory within IS literature, developed by Davis (1989) to assess the perceived ease of use and perceived usefulness of a system. Dennis, Wixom and Vandenberg (2001) integrated TTF with appropriation theories as developed by DeSanctis and Poole (1994) to create a hybrid Fit-Appropriation Model. In a study which explains the continuation of technology use of an e-Learning tool, Larsen, Sørenbø and Sørenbø (2009) combined the fit and utilisation constructs from TTF theory with the constructs of user beliefs and feelings as emphasised in the Post-Acceptance Model, proposed by Bhattacharjee (2001). Finally, Zhou, Lu and Wang (2010) presented an integrated model of TTF and the Unified Theory of Acceptance Usage of Technology (UTAUT), as proposed by Venkatesh, Morris, Davis and Davis (2003) to explain measures of user adoption and performance expectancy on mobile banking applications.

Thus, the literature paints TTF as a theory capable of covering a wide swathe of research perspectives, with the notion of fit – the central facet of TTF theory – able to be approached using various units of analysis and theoretical definitions. In spite of this broad applicability, the essential meaning of the theory itself remains constant: fit occurs as a function of the congruence or alignment between tasks and the technologies used to execute those tasks.

2.1.2 A bias towards quantitative research

The second aspect revealed during the literature review relates to the predominance of mostly quantitatively-based studies that are used to approach and verify aspects of TTF theory. TTF theory is represented in mostly survey-based or experimental studies that often use an individual unit of analysis to diagnose fit-related phenomena (Furneaux, 2012). These deductive studies tend to have a presumption of certain a priori conditions or hypotheses that pertain to the concept of fit, which all confer a degree of functional alignment between a specified task and a particular technology that is used to action the task. Most often, this measure of functional alignment implies a static, invariant state between the task and the technology examined. Furthermore, such studies usually present their findings in relative terms, expressing fit directly as a numeric value or a descriptive term, such as ‘misfit’, ‘weak fit’ or ‘moderate fit’ or indirectly, using surrogate measures such as ‘high utilisation’ or ‘strong performance’. When presented as such, it is natural to stretch the conceptual bounds of these definitions. For example, if the academic community accepts that TTF can be measured and that fit can be expressed in either numeric or descriptive terms, is it feasible that fit occurs at the extremes of these measurement definitions? For example, does zero or non-fit exist? At the other extreme of the measurement spectrum, does complete fit exist and, if so, what does it look like? My interest in identifying technological fit using a holistic research approach may help resolve these questions and thereby provide a potentially useful and more generalisable frame of reference for further discussions on TTF theory.

Finally, illustrating the theory using isolated, static and quite prescriptive research contexts is not reflective of an actual, whole organisational setting. Reality suggests that tasks actioned and fulfilled by technologies in knowledge work environments are more fluid and complex in nature than most of these studies indicate, adding weight to the argument that the topic be approached using alternative units of analysis and introducing the opportunity to formulate a dynamic and more social aspect to the TTF model.

2.1.3 Surrogate measures of fit

The third characteristic identified in the literature review of TTF relates to the use of surrogate measures to assess the notion of fit. As stated earlier, expressions of both TTF and fit appear capable of wide application in terms of their potential theoretical

definition and research perspective. This fluid nature of fit makes its operationalisation within any given study challenging. Furneaux (2012) highlights that TTF research may encounter difficulties in identifying key task demands, prioritising core technological capabilities, and selecting the most appropriate unit of measure. As regards to the third point in Furneaux's (2012) observation, most studies that attempt to assess the notion of fit use surrogate measures such as utilisation (Gebauer & Shaw, 2004), user satisfaction (Staples & Seddon, 2004), productivity (Fuller & Dennis, 2009), perceived ease of use and perceived usefulness (Dishaw & Strong, 1999) or individual performance (Goodhue & Thompson, 1995) to do so. In all these cases, researchers deem that fit moves as a function of such surrogate measures, which are fundamentally determined based on the alignment between task and technology (Goodhue & Thompson, 1995; Zigurs & Buckland, 1998).

The efficacy of these fit surrogates is moot and, in most cases, they often lack a relative or comparative value. A value that indicates 'good utilisation' or 'strong satisfaction' as a corollary to fit may be difficult to generalise outside the context of the research. To this end, Goodhue (1998, p. 106-107) himself states:

“...while performance is the desired bottom line, performance measures tend to be uni-dimensional, and as such are not very useful as a diagnostic (knowing only that performance is low does not give much insight into what actions might improve the situation)”.

More tellingly, measures such as utilisation, satisfaction and performance may in fact misinform the true 'fit' situation. It is quite conceivable that system users may indicate a high level of each surrogate measure, using technologies that, in reality, represent an overall poor fit. For example, over time, a system user may become highly proficient in navigating through a clumsy software application or an overly officious process imposed by an organisation. This use context may well skew utilisation and performance measures and scores of system satisfaction may, in fact, reflect the user's level of system understanding and proficiency, and thus disregard a more objective measure of the system itself. As such, fit definitions that attempt to measure TTF using mediating or moderating variables need to be considered carefully. Similarly, the use of more perceptual measures of fit, such as profile deviation or directly-assessed fit, may introduce an inappropriate level of subjectivity into what ought to be an impartial unit of measure (Hoehle & Huff, 2012). As an alternative to these measurable fit

perspectives, Strong and Volkoff (2010) paint the notion of fit using more descriptive terms. To recapitulate, the fit perspectives of “coverage” and “enablement”, suggested by Strong and Volkoff (2010), act as the respective antitheses to the misfit perspectives of “deficiencies” and “impositions”. These terms may appeal to researchers for several reasons: firstly, a descriptive perspective of fit, as opposed to a measurable one, potentially allows either a quantitative or qualitative research approach to a given TTF study. Secondly, a description of fit, as opposed to a measure of it, allows it to be captured in various units of analyses – a useful attribute which is congruent with the IS literature (Strong and Volkoff, 2010). Finally, by inverting misfit terms into fit-relevant terms, Strong and Volkoff (2010) introduce the possibility that fit can be situated along an imagined continuum. As technologies evolve to better reflect task requirements, tasks and technologies converge and misfit gives way to fit. Alternatively, a fit divergence might occur, as task requirements alter without a commensurate change in the supporting technology. Framed as such, examples of technological deficiencies and impositions are deemed to occur at the low end of a fit spectrum and technological enablement and coverage occur at the high end of a fit spectrum.

To summarise, TTF is widely represented as a theoretical model within IS literature. Its fundamental appeal lies in its relatively intuitive and simple nature, which succinctly conveys its central premise: fit occurs as task requirements, human capabilities and system functionalities align. As a theory, TTF appears to have wide application throughout a given organisational setting, with the literature indicating a research preference towards quantitative studies that often use surrogate phenomena to address the topic of fit. Having outlined the general theoretical basis of TTF and explored the various definitions of the fit component, it is appropriate to provide a formal definition of the two remaining components of the model - tasks and technologies.

2.2 A review of task theory

Early research into the nature of tasks was conducted by Perrow (1967) who examines the effects of routineness in the context of physical work environments and defined tasks as actions carried out by individuals in turning “inputs to outputs”. In spite of Perrow’s (1967) research context addressing manual labour, the definition remains broadly valid within a more modern, knowledge-based workplace. Additionally, Hackman (1969) defines a task as a set of assigned goals to be achieved, instructions to be performed or a mix of the two. Expanding on this definition, Wood (1986) suggests

that all tasks are comprised of three components: “products” (outcomes), “required acts and information cues” (p. 60), where the latter two components are the means for generating a product or outcome, which resonates with the productive terminology used by Perrow (1967).

The findings of several task theorists indicate that the nature of a task alters when applied to a group or collective context. Hackman, Jones and McGrath (1967) suggest that three types of intellectual group tasks exist: production, discussion and problem-solving tasks. Steiner (1972) classifies group tasks as either unitary, which results in a single outcome based on collective performance, or divisible categories. Davis, Laughlin and Komorita (1976) differentiate tasks based on whether they are performed cooperatively or competitively. Cooperative tasks include combined intellectual and decision tasks; competitive tasks include bargaining and negotiation tasks. The point to emphasise here is that task characteristics alter depending on whether they occur singularly or within group contexts and this aspect of task variability may be accentuated within a knowledge work environment.

A brief outline on the topic of knowledge work is warranted at this point. My study concentrates on a local office that forms part of a large, multi-national insurance broking firm operating chiefly as an intermediary on behalf of its clients within the insurance and re-insurance markets. Within this research context, I associate the business of insurance broking with knowledge work. The term knowledge work encapsulates the application of intangible, complex mental activities on information and knowledge (Davenport & Prusak, 1998; Drucker, 1999; Ramírez & Nembhard, 2004). Knowledge workers are those that apply their knowledge and particular expertise to gather, analyse, interpret and synthesise information (Drucker, 1999; Frick, 2010). Drucker (1999) suggests that knowledge work is characterised by the presence of a significant level of task identification, autonomy and innovation. Additionally, such work must contain an element of continuous learning and teaching and, from a more economic point of view, Drucker (1999) states that the productive output for knowledge work must be described in both qualitative and quantitative terms and knowledge workers must be seen as an asset rather than a cost.

In spite of the specificity Drucker (1999) brings to the knowledge work discussion, there is an absence of a singular, common definition in the literature, which has led to

numerous attempts to categorise the topic. Some academics take the view that knowledge work may be generalised based on its predominant attributes, such as creativity, portability and speciality (Dove, 1988). Coates (1986) divides knowledge workers into alternate positional categories: clerical, professional and managerial. Davenport (2002) extends this theme of knowledge worker categorisation, suggesting a generic taxonomy of four knowledge worker types: transactional, which is suggestive of work that is highly routine, with minimal allowance for individual discretion; integrated, which involves a range of formal, standardised and systematic work practices; collaborative, where work is improvisational and cross-functional in nature and; expert, which connotes highly discretionary, judgment-oriented work.

Although categorisation does help to conceptualise knowledge work, it may confine or sectionalise what is a fluid, dynamic and highly complex set of organisational activities. Such categorisations run the risk of ‘ring fencing’ job characteristics and, in so doing, fail to address the possibility that knowledge work may well exhibit cross-sectional characteristics, to varying degrees. Recognising this, Dahooie, Afrazeh and Hosseini (2011) frame knowledge work in very broad terms and provide two possible options for defining the term. The first of these is the “job-oriented” view, which concentrates on the task-centric attributes of knowledge, such as the occupational classification, activities or job characteristics of a given role. The second takes a more human-centric, “worker-oriented” view, emphasising individual traits, talents and behaviours. As such, the knowledge worker role is viewed as a function of what tasks individuals do and how they perform them, rather than what group or category a knowledge worker fits within. This study espouses the view adopted by Dahooie, Afrazeh and Hosseini (2011) and appropriates knowledge work as a continuum, where jobs, tasks and activities associated with a knowledge work environment may be variously positioned along this continuum (Dahooie, Afrazeh & Hosseini, 2011; Kelloway & Barling, 2000; Ramirez & Steudel, 2008).

Returning to the more specific discussion around the nature of tasks, my contention is that knowledge work environments not only involve a mix of both singular and group-based tasks but may also conflate certain knowledge work tasks. In other words, knowledge work may exhibit behaviour where the *same tasks* might need to be executed either by an individual or, on occasion, group-based action. For example, the arrangement of an insurance contract by an intermediary on behalf of a client is

generally regarded as an individual task, but on occasion, contingent circumstances may require the involvement of multiple parties to assist with the task, thereby introducing a range of differing, group-based task characteristics. Putting aside the possibility of mediated knowledge work for now, an assessment of knowledge work tasks first requires a formal means of classification. To assist with this, a task typology as suggested by McGrath (1984) presents us with a useful frame of reference. The work of McGrath (1984) expands on the earlier works of Hackman (1969), Steiner (1972), Laughlin (1980) and Shaw (1981), who all offer various classifications of tasks based on certain key task features. Using tasks observed within a group-based research context, McGrath (1984) established a broad classification that reflected four underlying processes implicit in all task characteristics: generate, choose, negotiate and execute. These levels represent the highest order of McGrath's (1984) typology and are represented as quadrants. Each process is then sub-divided into eight main task types: planning, creative, intellective, decision-making, cognitive conflict, mixed motive, negotiative and performance tasks. Finally, the typologies are then grouped based on their basic psychometric definitions, Behavioural – Conceptual and Co-operative - Conflictory - which are represented along the vertical and horizontal axes of the circumplex model. Table 2-1 summarises McGrath's (1984) task circumplex taxonomy.

Table 2-1: Summary of task taxonomy as per McGrath (1984)

Axes	Quadrant	Task Type	Example
Behavioural - Cooperative	I Generate	1. Planning	Budgeting; Agenda setting
Conceptual - Cooperative	I Generate	2. Creativity	Product design
Conceptual - Cooperative	II Choose	3. Intellective	Problem-solving
Conceptual - Conflictory	II Choose	4. Decision-making	Collective judgement or consensus building
Conceptual - Conflictory	III Negotiate	5. Cognitive conflict	Resolving different viewpoints
Behavioural - Conflictory	III Negotiate	6. Mixed motive	Making ethical or value-based decisions
Behavioural - Conflictory	IV Execute	7. Negotiative	Negotiating competitive deals
Behavioural - Cooperative	IV Execute	8. Performance	Co-ordination and physical action

McGrath's (1984) task circumplex model has been used widely in various forms of IS literature, in particular the study of group-support and communication-based technologies (DeSanctis & Gallupe, 1987; DeSanctis & Poole, 1994; Garton, Haythornthwaite & Wellman, 1997). The relevance of the circumplex model to knowledge work tasks has immediate benefits. Firstly, it adds a level of granularity that illuminates deeper layers of task characteristics that are often evident in knowledge work and shifts the focus away from describing knowledge work activities in purely process-oriented terms. Secondly, the circumplex model appears to offer a richer, multi-

dimensional view of task-type attributes, which is ideal for depicting the fluid and complex activities usually associated with knowledge work. For example, based on the numbered task types defined in Table 2-1, the act of report writing may invoke several task categories such as Type 2 – Creativity and Type 3 – Intellective. Additionally, where numerous parties have jointly provided input into a given knowledge work task, such as a report, task Type 4 – Collective Judgement may also contribute to the task mix. The use of a suitable typology defines the underlying characteristics of a task and therefore provides a theoretical grounding to help inform areas of potential fit causality.

Additionally, the literature suggests that the presence of task complexity is a common, significant factor to both TTF and knowledge work. Task complexity forms an inextricable link to the nature of knowledge work tasks and is regarded as a key determinant in the performance of knowledge work (Ramirez & Steudel, 2008; Dahooie, Afrazeh & Hosseini, 2011). Furthermore, the notion of task complexity is closely tied to TTF theory, as evidenced by the two central findings presented by Goodhue and Thompson (1995). Firstly, technology has a positive impact provided it is utilised and it represents a good fit for the tasks it supports. Secondly, systems will offer less functionality as tasks become more complex, resulting in a lower measure of fit.

Most of the major TTF studies that directly address the concept of complexity define it along two key dimensions: the extent to which a task is deemed “non-routine” and the degree of “interdependence” a task demands (Goodhue & Thompson, 1995; Zigurs & Buckland, 1998). Non-routineness takes into account two factors: structure and difficulty. Structure is a function of the variability and the number exceptions implicit in a task; difficulty is a function of task analysability and predictability. The second dimension, task interdependence, is defined as the degree to which a task is related to other tasks and the level of co-ordination required with other organisational units (Zigurs, Buckland, Connolly, & Wilson, 1999).

Two issues related to these task complexity dimensions present themselves, namely, task complexity equivalence and task analysability. Addressing the first issue, the task complexity theory highlighted above appears to confer an equivalent value of complexity for all instances of a given task. Given the possibility that a task, especially one performed within the context of knowledge work, may vary by degrees of complexity, based on a mix of objective and subjective factors, any measure of such

must reflect that the same tasks performed on different subjects cannot be deemed equally complex (Feltham & Wu, 2000; Schnedler, 2006). Knowledge work is comprised of a complex and fluid set of activities and interactions. Conferring equivalence for each occurrence of that task or activity seems overly facile. The fundamental issue with assessing knowledge work tasks lies in the highly differentiated products and services that are integral to a knowledge work environment and the unique, variable conditions that are embodied in the activities, tasks and jobs performed in such an environment.

The second issue to address is task analysability. Knowledge work tasks generally require a degree of individual flexibility and autonomy to allow for their successful execution (Ramirez & Steudel, 2008). Rice (1992) defines task analysability as “predetermined responses to potential problems, and well known procedures, (which) are available and useful, because outcomes are well understood” (p. 478). Conversely, unanalysable tasks require higher levels of intuition, creativity and judgement (Simon, 1983). The improvisational and personal nature of these task types force knowledge workers to “create or find satisfactory solutions to problems outside of the domain of facts, rules, or procedures” (Rice, 1992, p. 479). A term called “informatisation” further assists the clarification of the task analysability concept. Informatisation is a concept attributed to Kallinikos (2007), who describes it as the ability to break down an entire operation into its atomic constituents, and then rebuild that operation into a revised, digitised format. All functions, roles and tasks associated with an operation are analysed and whittled down into discrete processes, to the point where each unit of work can be entirely expressed in a code-based or programmatic format. The most immediate implication of task analysability or the informatisation of tasks, in terms of the central question this study seeks to address is this: analysable tasks are more capable of representation in a technological solution. The more a job, role or task is capable of being accurately codified, the greater the likelihood of an adequate technological representation and, thus, a better fit outcome potentially is produced. Certain tasks executed as part of the knowledge worker’s role may well fall into the unanalysable task category and as such may lack adequate technological representation, thereby impinging upon a given measure of TTF.

Gill and Hicks (2006) delve deeper into the topic of task complexity, framing it specifically from an IS perspective and conclude that using objective complexity

definitions alone within an information technology context has its limitations. To overcome these perceived shortcomings, Gill and Hicks (2006) undertake a broad review of salient literature in an attempt to identify themes common to task complexity. Their efforts result in a complexity model consisting of thirteen separate dimensions, which then condense into five classifications. In doing so, Gill and Hick's (2006) study broadens the task complexity discussion by introducing more variable, dynamic and task-related classifications including information processing complexity, problem space and lack of structure complexity, as well as acknowledging the conventional complexity classifications of experiential and objective complexity.

In summary, a task is defined as a unit of work performed to meet an individual or organisational objective. It occurs as a sub-set of a job and may exist as a discrete, individually identifiable unit of work or may comprise a smaller set of sub-tasks or activities. Within a given knowledge work environment, the worker will perform various jobs, both individually and collectively, as a part of their role or functional position. The literature suggests that task complexity and knowledge work are a natural pairing and task complexity forms a significant component of the task construct of the TTF model when that model is applied to a knowledge work context. Furthermore, the nature of knowledge work means the same task performed as part of a job may vary based on a mix of subjectivities, such as individual experience or specific client requirements, or intrinsic complexities, such as the scale or nature of an underlying client business. Although the general goals and objectives of particular knowledge work tasks may be similar, each instance of a knowledge work task varies and thus cannot be regarded as universally equivalent. Whether this significance is recognised in the technologies that are used to perform these tasks is moot and is proposed as a fundamental area of research. More crucially, while the existence and influence of task complexity is acknowledged within TTF theory, its appropriation within a suitable conceptual model is not. A discussion on how task variability and task complexity can be adequately reflected in a suitable conceptual model of Task-Technology Fit is warranted. To this end, McGrath's (1984) task typology model and Gill and Hicks' (2006) classification of task complexity present suitable analytic models applicable for the assessment of knowledge work tasks.

2.2 A review of technology theory

Of the three components that comprise the TTF model, a precise, theoretical definition of technology is perhaps the most difficult to establish. In all likelihood, this difficulty stems from the general issues most theorists have in pinning down an overall definition of the term. Technology derives its meaning from the Greek word ‘technē’, which translates to ‘skill’, ‘craft’ or ‘art’. As Misa (2009) points out, art presents itself as a very broad and “complex expression of human creativity” (p. 8). Attempting to distil the term into a succinct, clear and universally recognisable definition is certainly fraught and possibly futile. By association, a formal definition of technology is equally vexing. Compounding this issue is the extent to which technology has ingrained itself into modern life. We see its presence everywhere: it exists in what we eat, what we wear, where we live and work. It transports us, entertains us, teaches us and heals us. It exerts an indelible influence over how we live. As a result of this diffusion, it represents different things to different people. Li-Hua (2009, p. 18) articulates this as follows:

“To a scientist, technology is the end product of one’s research. To an engineer, technology is a tool or process that can be employed to build better products or solve technical problems. To an attorney, technology is intellectual property to be protected and guarded. To a business executive, technology may be the most important, yet least understood, company asset”.

This study approaches technology in terms of its use within the context of an information and communication system but this specification does little to provide a workable frame of reference for a typical piece of research. Li-Hua’s (2009) observation highlights the various extensive interpretations of technology; equally, a single identified technological artefact may be viewed intensively, from various angles, such as its layered technical architecture, how it is perceived and used by various organisational actors, its interaction with other technologies and so on. Providing a suitable definition of technology can be difficult. For this reason, it is important to underpin a discussion that relates to technology with a central objective in mind. This study seeks to identify causalities of fit, which are deemed to occur as a function of the technologies used by knowledge workers to perform their tasks. As a starting point for this topic of discussion, I first look to the definitions of the technology component embodied within TTF literature.

Most past studies pertaining to TTF frame the notion of technology in quite specific terms. For example, Gebauer and Ginsburg (2009) look at TTF specifically as a function of mobile information system use; Chang (2008) uses TTF to underpin research of consumer interaction with online auction sites; D'Ambra and Wilson (2004) explore use of an internet-based airline booking system; Dishaw and Strong (1998) apply the model against the use of a particular set of software maintenance tools and, as mentioned previously, Zigurs et al. (1999) review the model within the context of group support systems. As noted in earlier sections, the singular and specific technological contexts that these studies reference make the generalisation of the technology component difficult. Furthermore, most individuals and organisations have an array of technologies available to them to perform various activities; fixating on the presence of a single application may not necessarily reflect the real world use of an information system or set of technologies. Goodhue and Thompson (1995) depart from such singular interpretations of technology and offer a comparatively wider definition, which is stated as: "In the context of information systems research, technology refers to computer systems (hardware, software, and data and user support services (training, help lines, etc.) provided to assist users in their tasks" (p. 216).

From the point of view of this study, in order to derive a causal explanation of fit, the definition of the technology artefact needs to incorporate more than just the stable of tools an individual user has access to. Technology ought to represent a deeper, more layered construct, consisting of codified logic, interfaces, innate design features and functionality including its potential to be adapted and modified over a period of time.

Strong and Volkoff (2010) address the need to provide a clear and specific theoretical definition of the term 'technology' and note that much IS literature lacks "a clear theoretical characterisation of the information technology artefact" (p. 732). To provide such a definition, Strong and Volkoff (2010) refer to the works of Wand and Weber (1990) and Weber (1997) and conceptualise technology using the following four structural forms:

1. A surface structure, which represents an area within the technology that facilitates user interaction with a system. This structure correlates to the "technology as a tool"

- anecdote (Wand & Weber, 1990), which usually associates to human-computer interaction and user experience facets of technology;
2. A deep structure, which addresses the need for a technology to mimic or represent an organisational reality. Representation occurs in the technology's deep structure, where 'scripts', procedures and business logic provide a codified interpretation of real world entities. It occurs where technology is used to reflect the states, transformations and properties of objects it seeks to represent. This structure correlates to the "technology as representation" anecdote (Wand & Weber, 1990), where technology assumes a virtual interpretation of real world conditions, states or scenarios;
 3. A physical structure, which translates to the technological hardware. The physical structure unifies the technology artefact by bringing the technology as tool and technology as representation into a single, physical presence;
 4. A latent structure, which acts as a construct to capture the misfit domains of control, roles and culture. These misfit domains are deemed to be latent as they are not specifically or primarily 'coded' into a system but emerge from technological use as "second order structures".

Using these structures within the bounds of an IS solution, issues related to fit may occur in any one, some or all of the above structures, but broadly speaking, one may categorise these structures as either technical or social. The technical category relates to the more informational and mechanistic fit dimensions of a technology, such as the logical design of a database, code-based procedures or the manner in which data are presented back to an end-user. Technical fit issues are more likely to naturally occur within the surface, the deep and/or the physical structures of technology. In other words, a high fit measure within the surface structure occurs when human-computer interaction occurs within a consistent, intuitive and easy-to-use experience. Fit within the deep structure or representative layer occurs when organisational reality has been correctly interpreted by system designers and adequately converted into procedural code by system developers. Fit within the physical structure occurs when an IS solution can be optimally utilised and contained in a variety of physical forms. For example, technology that is only capable of working with particular hardware configurations or is confined to a desktop environment using keyboard and screen as the sole input-output devices, demonstrates less fit compared to a solution that deploys to any environment or is device-agnostic.

Strong and Volkoff's (2010) introduction of latent fit structures provides a more social avenue to describe or attribute fit-related phenomena. Latent fit posits that the effects of fit may extend past tasks and technologies alone to include, roles, culture and organisational structures.

In sum, the surface, the deep and the physical structures are all interpreted as non-human, technical artefacts, whereas latent structures are essentially human in nature. Whilst deemed "second order structures", the presence of such latent structures, in terms of their potential to influence fit causation, must be treated with exactly the same weight as technical ones. That is, in the quest to uncover causalities of fit, the research produced by Strong and Volkoff (2010) indicates that such exploration cannot just concentrate on the technical aspects of a system - the area where the majority of TTF studies focus; a social element appears to be in play also. Described as such, Strong and Volkoff's (2010) conceptualisation of the technology artefact, together with the multilevel unit of analysis proposed by their research, offers a robust and holistic perspective that comprehensively addresses causalities of technological fit.

A core attribute of technology relates to its capability or potential to adapt and evolve. Drawing on work proposed by Kauffman (1993) pertaining to evolutionary biology, Fleming and Sorenson (2001) attempt to develop a theory of technological invention, based on complex adaptive system theory. Fleming and Sorenson (2001) describe invention as a process of "recombinant search" that involves the incorporation or combination of old and new technologies, which, if successful, either synthesise novel technology or refines and improves the use of an existing technology. Similarly, Arthur (2009) echoes many of these insights, and expresses technological development using similar biological, almost organic terminology. In his study, Arthur (2009) highlights the recursive, dynamic and self-perpetuating nature of technological change and notes that new manifestations of technology are the products of earlier forms, a process he refers to as "evolution by combination, or more succinctly, combinatorial evolution" (p. 22).

There are some limitations when using a biological paradigm to describe technological development. Firstly, the process of recombination within an evolutionary biological system is made manifest by chaotic, arbitrary pairings; the evolution of a technological

system implies the involvement of intelligent actors, purposeful and deliberate design and a level of comprehension and foresight of what combinations are most likely to work. At a more philosophical level, in describing technology in fundamentally organic, almost self-aware terms, both studies run the risk of attributing an essential power to technology that may not in fact exist. When technology is eulogised as being autonomous, omnipresent and self-creating, it becomes deified, and neglects the idea that technology evolves primarily as a function of human creativity and input, not in spite of it. It represents a means of harnessing natural forces and phenomena and is not a force in and of itself. Nevertheless, the works of Fleming and Sorenson (2001) and Arthur (2009) provide insights into the many parallels that exist in biological, social and technical systems. All share the attributes of perpetual recombination, inheritance and adaptability. That technology is capable of adaptation and rapid change is demonstrably true. Human-computer interfaces have evolved from punch card input, through to typed, command-line instructions entered via keyboards, to ‘point and click’ input using a mouse within a graphical user interface, through to touch-screen and voice-activated interaction that is common in present-day mobile devices. Once the domain of highly qualified electronic engineers, computer technology has evolved to the point where pre-school children now use electronic devices to play, learn and communicate. This adaptive capacity or proverbial ‘technological DNA’ is an area that appears to have a particular resonance with the topic of Task-Technology Fit, especially as it potentially relates to a more dynamic conceptual model.

Henfridsson and Bygstad (2013) apply the discussion of technological evolution to a case study of Norwegian Air, using a critical realist perspective to help identify which mechanisms contingently cause digital infrastructure evolution. Within their study, Henfridsson and Bygstad (2013) describe digital infrastructure in holistic terms, one which comprises both socio-technical networking and processing elements. The evolution of such an infrastructure occurs as a gradual process by which a “digitally-enabled infrastructure changes into a more complex form” (p. 908). Throughout their four year case study of the subject firm, Henfridsson and Bygstad (2013) noted the prevalence of a loosely-coupled, Service Oriented Architecture (SOA) throughout the organisation, and the existence of a pervasive, open and entrepreneurial culture, the presence of which were deemed to be contextually significant in terms of digital infrastructure evolution.

Certain fundamental assumptions about the nature of digital infrastructure mechanisms are emphasised in Henfridsson and Bygstad's (2013) study. Firstly, it is assumed such mechanisms are "self-reinforcing", a concept that is akin to the notion of recursion or feedback. Secondly, such mechanisms are deemed to be composite, comprised of three substrates: situational (macro-level) mechanisms, action-forming (socio-technical) mechanisms and transformational (micro) mechanisms. Finally, the authors ascribe a third assumptive mechanism to the technology itself, suggesting that an innate adaptive mechanism occurs in most instances of a given technology. Based on these assumptions, three mechanisms were subsequently identified as having a causal influence over technological evolution: the Innovation Mechanism, the Adoption Mechanism and the Scaling Mechanism. The Innovation Mechanism derives its existence from the SOA platform identified in Henfridsson and Bygstad's (2013) study. The presence of an SOA infrastructure enables flexibility, which spawns an innovative culture throughout the business, which may not have been evident otherwise. The Adoption Mechanism pertains to the relative ease with which new services can be incorporated into the technical infrastructure. The Adoption Mechanism establishes a virtuous, recursive cycle of additional users, who adopt more services, creating more revenue, which allows more resources to create more services and so on. The Scaling Mechanism relates to the use of an open architectural standard evident in the SOA platform. This configuration allows integration with various other external, affiliated partners. Thus, architectural scale, in this sense, relates to an increased infrastructural reach external to the organisation itself.

The most striking aspect of Henfridsson and Bygstad's (2013) case study relates to the unheralded series of shifts in their subject firm's business model. The combined influence of a small, expert team of technicians, a strong entrepreneurial ethos throughout the firm and a well-defined business strategy that aligned with technology requirements enabled the creation of bespoke, re-usable business applications within a flexible, open source SOA platform. Unencumbered by any pre-existing legacy systems, and using an agile design approach to software development, technology solutions were quickly delivered back to the business. Once deployed, functionality was subsequently refined and improved based on observed user experience. The scalability of the SOA platform allowed central services to be socialised to certain relevant external parties and vendors, such as accommodation and rental car firms, which augmented an already successful business model and provided another level of feedback to reinforce the firm's

innovative culture. Such was the success of this approach that the business diversified into banking and mobile phone markets – a radical strategic shift in the business model, which Henfridsson and Bygstad (2013) wholly ascribe to the success of the underlying SOA platform used by Norwegian Air. The existence of a flexible, loosely-coupled technological architecture provided a capability to develop and deploy business solutions rapidly, which in turn fostered a strong, strategic alignment between the business direction and the supporting technological platform. Henfridsson and Bygstad (2013) make the argument that the choice of technological platform used within an organisation dictates the evolutionary mechanisms of innovation, adoption and scalability, all of which directly contribute to the notion of fit.

Two themes in particular stand out in Strong and Volkoff's (2010) and Henfridsson and Bygstad's (2013) respective studies; firstly, both studies indicate that the causal mechanisms of fit impact on organisational structures, emphasising that technology use does not occur in a vacuum. Both studies present technology not only as a means to support a task but also as a potentially transformative force over organisational structures, roles and people. Thus, both studies imply an inextricable link between the social and the material worlds that we all engage in; a perspective often missing from conventional studies of TTF. The notion of human action being enmeshed with technical or non-human objects draws from several theoretical positions, such as sociomateriality (*cf.*, Leonardi, 2013; Orlikowski, 1992) and actor-network theory (*cf.*, Callon, 1986; Latour, 1986).

The second area both studies touch upon relates to the multi-dimensional or layered nature of the technological construct. Certainly, technology exists in terms of what we can actually observe, based on end-user interaction and physical infrastructure, and most traditional studies of TTF concentrate exclusively within this area of analysis. However, a critical realist perspective of technology suggests that it is constituted in further, deeper layers that extend past what we can see. Strong and Volkoff's (2010) "deep structures", Wand and Weber's (1997) "technology as a representation" and Henfridsson and Bygstad's (2013) layered configurations of digital infrastructure mechanisms all variously present as events, mechanisms and structural entities which preside in unobservable real or actual domains. Thus, technology is additionally presented in less tangible terms, existing in the form of codified business logic, which is meant to emulate and represent the rules, procedures and policies of an organisation as

well as acknowledge its influence over social artefacts, such as roles, organisational structures and culture. Finally, technology, as a layered construct, exists not only in what it does but what it is capable of doing – a form of potential which is encapsulated in Henfridsson and Bygstad's (2013) definitions of the innovation, adoption and scaling mechanisms entrenched in particular technological configurations.

To summarise, due to its extraordinary diffusion, a universal description or classification of technology remains elusive. According to several academics, the popular enchantment with technology lies in its adaptive potential, allowing it to be developed and improved by progressively combining it with other technologies. The concept of a technology's adaptive potential ties substantially to its ability to progressively better reflect task characteristics and thus, it appears to be strongly associated with fit. The conventional definition of technology within studies related to TTF pertains to its effect over the tasks it supports. However, the literature indicates that the technological definition ought to also consider its capability to be shaped by the environment it exists within and its capability to shape that environment. Finally, as this study seeks to uncover causalities of fit, any description or representation of a technological artefact needs to reflect this research objective. To achieve this, I appropriate Strong and Volkoff's (2010) perspective of a layered technology artefact. Specifically, technology, in terms of its association within the TTF model, is conceptualised using the physical, surface, deep and latent structures Strong and Volkoff (2010) articulate. The notion of fit is assumed to occur in one, some or all of these layered structures. Additionally, the notion of fit resonates with the adaptive potential implicit in most examples of technology. To this end, I appropriate Henfridsson and Bygstad's (2013) proposed innovation, adoption and scaling mechanisms of technological evolution to help theorise how fit moves between tasks, technologies and the human actors engaged with both.

Chapter 3 Methodology

3.1 Chapter outline

The Literature Review chapter presents Task-Technology Fit (TTF) as a widely researched subject within Information Systems (IS), represented within a broad array of various research perspectives. Most studies that adopt the TTF model employ experimental or diagnostic research methods to describe the phenomenon of fit. This research aims to provide insights into the underlying causalities of fit, albeit expressed within a specific research context, and potentially cast new light on the existing theory. To achieve this objective, insights germane to the research question are gleaned from textual data to obtain causal themes. This chapter describes the methodological approach used to derive these themes and is divided into three main sections. The first section outlines the critical realist position (Bhaskar, 1975), which is the underlying philosophy that guides the direction and methodology of this research. The second section describes the research context by briefly introducing the participating organisation itself. The extent and direction of the research is bounded within a scope and includes a definition of the unit of analysis and the criteria governing participant selection in the research (Baxter & Jack, 2008). The final section of this chapter outlines the methodologies used to collect and analyse the research data.

3.2 Research philosophy

3.2.1 Ontological and epistemological perspectives

Most Western academics tend to regard the early Greek philosophical movements as the first proponents to establish and define a formal position on knowledge. These early schools were initially concerned with observing matter and motion, with the study and debate developing into more involved metaphysical discussions, which seek to explain the existence and fundamental nature of being and matter. Two core but contending themes emerged from these early Hellenistic philosophies: a Parmenidean view, which promotes a static, stable and predictable reality and a Heraclitean view, which advocates a fluid, ever-changing reality. The Parmenidean view largely aligns with positivist philosophy and maintains that a meaningful reality exists external to human consciousness and, as outlined above, this reality presents as a stable, observable and thus predicable universe. Phenomena observed in this reality are capable of

independent, repeatable and objective study, which has resulted in a strong association between the positivist philosophical position and those studies concerning the physical and natural sciences. For the most part, early research efforts within the realm of social science were initially established in the positivist tradition (Flick, 2006). The suitability of this approach became increasingly contentious during the early-to-mid twentieth century, which saw the development and adoption of a more interpretivist perspective within sociological studies.

An interpretivist philosophy maintains that reality is internally derived and individually interpreted. According to this view, reality can only be explored through the efforts and intervention of the researcher, resulting in an unavoidable bond between the observer and the observed. This relationship results in the observer deriving meaning or comprehension of the observed phenomena, thereby making the process of knowledge formation a personal, subjective experience (Flick, 2006).

Thus, where the positivist tradition emphasises detachment and objectivity, the interpretivist tradition emphasises engagement and subjectivity. As such, a person's ontological position naturally determines what they deem to be true and forms the underlying basis of what is assumed to be knowledge. Epistemology is concerned with the acquisition and validation of knowledge. It refers to what is assumed about knowledge and how it might be obtained. According to Brewerton and Millward (2001), it is the interface between "what distinguishes defensible belief from opinion" (p. 193). The significance of these two essential philosophical concepts – ontology and epistemology - cannot be understated, as they fundamentally influence the basis and direction of all research work – regardless of whether that work is quantitative or qualitative in nature. According to Baptiste (2001), attending to one's paradigmatic stance is a crucial prerequisite to any form of analysis and offers two essential benefits: it firstly establishes the ontological and epistemological position of the researcher and thus provides a philosophical context for the research. Secondly, having established a philosophical view on things, Baptiste (2001) suggests this exercise improves the overall quality of the research and addresses the unavoidable fact that all research is influenced, to varying degrees, by the underlying assumptions and beliefs of the researcher.

However, disagreement exists over whether these research paradigms or underlying epistemologies are mutually exclusive (Murphy & Dingwall, 2001) or capable of co-existence within a single study (Atkinson, 1995). How one approaches and resolves such contentions in a given piece of research is important. To recapitulate, this research addresses the causal factors or mechanisms of fit, as they apply to the TTF theoretical model. It approaches this topic by drawing out the collective observations and personal reflections from various research participants about phenomena that occur within the context of knowledge work. These observed phenomena and reflections may occur as either external events or individual experiences – thus indicating a mix of both objective and subjective influences. Furthermore, this particular study explores business-related phenomena, framed in the form of IS research - a social science that concerns itself with the interaction between people and technology. That is, the research is neither wholly technical nor is it entirely social. A purely positivist stance may not provide sufficient depth posed by the research question. Broadly speaking, positivistic enquiry is predictive and generalist in nature, testing hypotheses using dependent and independent variables. Such an approach may fail to glean the necessary rich, contextual data a study of this nature requires. Conversely, a strongly subjectivist position may run the risk of being overly inferential, shunning the possibility that some form of external association or causality may occur within the phenomena researched. A more moderate position capable of practically resolving these ontological differences is, therefore, required. As such, I seek a position that reconciles the co-existence of an external reality and an inner meaning; a critical realist philosophy appears to offer exactly that.

3.2.2 An overview of critical realism

Critical realism is a philosophical approach articulated by Bhaskar (1975) that bridges two separate paradigmatic worlds, by combining a scientific position in the form of transcendental realism with a social position in the form of critical naturalism. The philosophy defends a realist ontology, prescribing the existence of an external reality, that exists independently of human beings. If one were to imagine an event that caused all human beings to instantly vanish, critical realism contends that the natural order of things would continue on unabated – a so-called “intransitive” reality. It equally recognises that knowledge is socially constructed and acknowledges the perceptual limitations we, as observers of this reality, have. A critical realist perspective concedes that knowledge is both fallible and constrained. Knowledge is said to be “transitive”,

meaning that it is relative to location and time as well as individual perception and understanding. The acceptance of this “epistemic relativity” therefore encapsulates the ‘critical’ component of the philosophy. It is worth pointing out however that this stance does not equate to “judgemental relativity”, which holds that all viewpoints are equally valid. In other words, critical realism maintains a rational position when assessing knowledge, holding that certain views, explanations or theories better approximate reality than others.

One of the central characteristics of the critical realist view pertains to how one paints a picture of reality. Bhaskar (1975) presents reality as a series of three separate and virtual layers. We, as actors exposed to and involved within this reality, only observe, sense or perceive one aspect of this layered world. The layer or ‘domain’ in which we encounter some form of experience, or where objects and events are capable of observation or physical perception is called the “empirical domain”. However, critical realism maintains that our experiences of events and objects do not somehow ‘magic’ themselves into existence. They occur as a result of other unseen forces, interactions and underlying events. Outside of our experienced, empirical domain exists further unseen worlds, where invisible interactions, catalysts, constraints and events occur – a so-called “actual domain” of reality. Beyond this actual domain exists the fundamental layer of the critical realist world – the “real domain”. Bhaskar (1975) describes this essential, atomic layer of reality in terms of entities or “structures” which form the conceptual building blocks of the philosophy. Structures may include things such as animate or inanimate objects, simple or complex processes, forces, concepts or ideas. Structures have innate and enduring properties, which create a propensity to act or behave in particular ways or variously inter-relate with other structures, a phenomenon which Bhaskar (1975) refers to as a “generative mechanism”. Bunge (2004) helps better define a mechanism by providing the following description. A mechanism is “one of the processes in a concrete system that makes it what it is - for example, metabolism in cells, inter-neuronal connections in brains, work in factories and offices, research in laboratories, and litigation in courts of law” (p. 182). Crucially, this description, whilst useful, should not be interpreted as assigning a linear, deterministic nature to mechanisms. Mechanisms are caused contingently, where the interactions between structures and mechanisms ‘bubble up’ to actualise the causation or constraint of

particular events, which in turn, are observed or experienced by us. Described as such, a typical piece of critical realist research is primarily concerned with causality.

This layered reality is depicted in Figure 3-1, where the real domain presents as a super-set, containing structures and mechanisms. Generative mechanisms may (or may not) cause or constrain the actualisation of events, which are presented as a sub-set called the actual domain, which are perceived, experienced or observed within a further sub-set called the empirical domain.

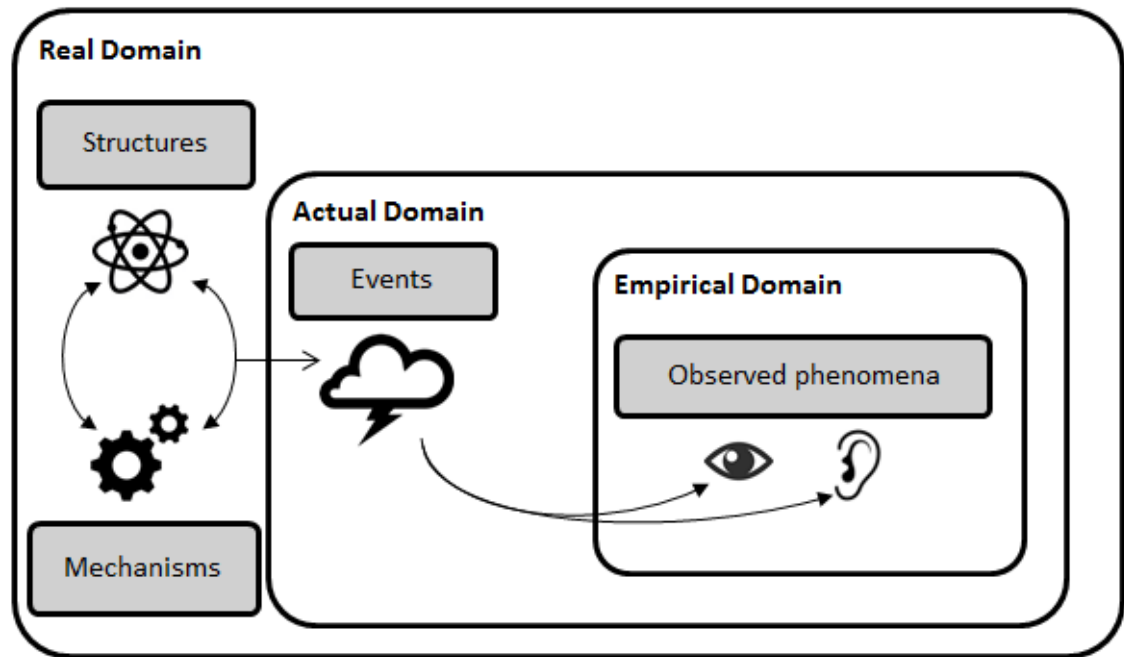


Figure 3-1: Critical realist conception of the Stratified Ontological Domain (adapted from Bhaskar, 1975)

There is an increasing recognition and adoption of critical realism as an underlying philosophical position within IS literature (Carlsson, 2006; Mingers, 2001; Mingers, Mutch & Wilcocks, 2013). Its ability to approach social analysis with a scientific posture, whilst simultaneously recognising the significance of individual meaning within a given piece of research, reconciles two opposite ontological positions. Crucially, its stratified framework, which outlines a world consisting of complex, imperceptible generative mechanisms that result in actual events, may provide a sound, formal basis for resolving widely recognised, but poorly understood, business phenomena.

To summarise, critical realism combines a realist ontology with an interpretive epistemology (Archer et al., 2013). Critical realist research is essentially explanatory (Easton, 2009) and fundamentally seeks to derive or link causality to observed events, explicated via the notion of generative or causal mechanisms (Wynn & Williams, 2012). Where positivist research seeks to investigate and measure event-level phenomena, critical realist research seeks to reveal and describe causal mechanisms that produce these events. Accordingly, a critical realist methodology does not attempt to generalise events in the manner of positivist research but rather it attempts to provide a theoretical description of lower level structures and mechanisms, in order to hypothesise a causal explanation. According to Bygstad and Munkvold (2011), a typical critical realist research design “involves an intensive study, with a limited number of cases, where the researcher systematically analyses the interplay between the layers. The methodological question is: how do we identify mechanisms, since they are not observable?” (p. 3). This question is addressed in the following sections.

3.3 Research design

Given the reconciliatory nature of the critical realist position, it is not surprising that there is a high level of tolerance for various research methods, be they quantitative or qualitative in nature. The critical realist approach to research is a fundamentally pragmatic one and is more concerned with the alignment of optimal research methods based on the nature of the object of study rather than the dogmatic adherence to a traditional philosophical position (Sayer, 2000). To recapitulate, this study seeks to obtain perspectives on the concepts of fit, technology and task based on the reflections of individuals within the research context with a view to determine possible causalities of fit. It achieves this through an understanding of what technologies are used by individuals within the participating organisation, how those technologies are used in terms of their application to a given task and why they are used. Aligning this research objective to a critical realist stance, the observed phenomena of this study are represented by the tasks undertaken and the technologies used by various knowledge workers within the participating organisation. These observations will then form the basis of establishing the underlying structures and mechanisms that influence the fit between said tasks and technologies.

3.4 Unit of analysis

This study uses the knowledge worker role as the central unit of analysis and conceptualises a role as an organisational construct that intersects between a particular job and an individual employed or contracted to perform that job. More specifically, the term ‘role’ in this sense is analogous to a persons’ functional position or title. A typical knowledge work environment, especially one that has a large, multi-national presence, will invariably contain numerous roles, with each role likely to utilise an array of technologies to fulfil the tasks associated with that role. Additionally, each role will likely consist of tasks, duties and activities, each of which classify as a form of knowledge work, based on earlier definitions of the term. The selection of this particular unit of analysis appeals for several reasons. Firstly, it allows for individual reflection as well as possible inter-role comparisons. Secondly, as a unit of analysis, a role is representative of a collection of individual actors, who each represent a particular business unit within the firm and, as such, the role is positioned between the individual and organisational analytical levels.

In order to obtain a targeted and meaningful view of task-technology use in a knowledge work environment, a suitable method needs to be applied to establish relevant participant selection criteria within the research context (Baxter & Jack, 2008). Research participants are individuals employed or contracted by the participating organisation, who can reasonably be defined as ‘knowledge workers’ and who are familiar with the defined processes and technologies associated with a specific knowledge worker role. As such, research participants are both ‘task doers’ and ‘end users’ in terms of the actions they perform and technologies they engage with. Participant selection was determined based on three main criteria:

1. The participant’s role must conform to the definition of knowledge work. In a general sense, a knowledge worker role involves the treatment, processing or shaping of data and informational inputs in order to produce higher order informational outputs (Ramirez & Steudel, 2008). Role selection occurs from the array of organisational units or practices that segment the subject firm;
2. Participant experience is considered an important criterion and is determined by the length of time spent in the current role as well as exposure to a given set of technologies. A participant must have at least three years’ experience in the current

role, to ensure a participant has a full appreciation of the various tasks performed and technologies used;

3. Organisational representation is the final aspect of selection, which seeks a balanced representative sample of all the main organisational business units that make up the participating organisation. Knowledge worker roles occur within the majority of these business units, which may be broadly categorised as either ‘client-facing’ or ‘supportive’. The majority of participant roles have a client-facing, intermediated or consultative element to them, although the study does extend to include managerial and support-centric roles, such as finance and accounting, in order to highlight potential thematic differences related to TTF. Client-facing roles occur in seven possible business units – commercial, corporate, group benefits, financial and executive risk, captive management, re-insurance and risk consulting. A total of 53 individuals in the research location were spread throughout these business units. Supportive roles may occur within one of the following business units: accounting and finance, legal and compliance, marketing support and information and communication technology. A total of 12 individuals were associated to these various business units. The selection methodology identified participants based on their assignment to a specific business unit, with particular emphasis placed on individuals engaged in client-facing roles.

3.5 Data collection

The research was conducted within a single location in Auckland, New Zealand, which exists as a branch office of a much larger international insurance broking organisation. A total of 65 individuals (the total combined number of client-facing and support staff) were counted in this single location at the time of writing, with each individual performing a particular role within a designated practice or business unit. Based on the criteria of knowledge worker role, experience and organisational representation, a selection of eligible participants from the participating organisation was invited to be interviewed.

All candidates were contacted via e-mail, which also included an attached information sheet that provided an overview of the research and its objectives. A copy of the information sheet is provided in Appendix 1. The first round of these invitations targeted those knowledge workers whose role mostly involved client-facing tasks. Of

the first six candidates invited to participate, five replied and agreed to be interviewed; one candidate did not reply. A subsequent round of invitations was issued to three further candidates after the initial interviews were completed. The roles associated with these three particular knowledge workers were more mixed in nature and included accounting and management roles. All three candidates responded and agreed to be interviewed. Each interview commenced with a brief introduction of the research topic, plus confirmation each participant had read and understood the information sheet provided with the invitation. Care was taken to ensure discussions about the research topic were only lightly covered, to prevent introducing potentially biased responses. Having studied the topic outline and the basis for the interview, each participant was then asked to review and sign a consent form, which confirmed their understanding of the interview as well as the respective rights and obligations of each party in the interview. The consent form also contained selectable options which provided each participant the opportunity to obtain a copy of their completed interview transcript as well as the results of the completed research.

The technique used to collect data was a semi-structured interview. The use of semi-structured interviews is a common form of data collection in qualitative analysis (Gray, 2009) and also has wide acceptance in many critical realist studies (Zachariadis, Scott & Barrett, 2013). In total, eight semi-structured interviews were carried out on selected participants. The total duration of all interviews amounted to 7.5 hours. Individual interview duration ranged from 45 to 75 minutes, averaging 60 minutes. The participants' time in their current role ranged from 3 years to 13 years, and overall industry experience ranged from 8 years to 30 years. The overall group consisted of 5 males and 3 females. Table 3-1 provides a summation of these role profiles.

Table 3-1: Participant Role Profiles

Role	Gender	Experience (years)	Time in role (years)	# Clients
Account Director	Male	14	3	1
Corporate Retail Broker	Male	30	3	10 – 12
Captive Management Consultant	Female	11	8	9
Specialist Technical Broker	Female	10	6.5	110
Re-Insurance Broker	Female	8	3.5	9 - 10
Accounting Finance Support	Male	30	4.5	N/A
Commercial Retail Broker	Male	20	13	230
National Accounts Manager	Male	24	5	30

The interview form contained questions related to the tasks and technologies typically associated with the participant's role, together with individual perceptions about

organisational structures and support. The interview form was divided into six sections that covered the following topics:

1. Basic personal data and work experience – this section obtained the amount of time spent in the current role as well as each participant's overall work experience within the insurance industry;
2. Nature of the role and work performed – this section obtained a description of the main aspects of the role in terms of tasks and activities performed;
3. Predictability, creativity, innovation, and personal judgement – this section obtained an assessment of the extent to which a role is impacted by each of these four knowledge work dimensions;
4. Perceptions about complexity and difficulty – this section posed a series of questions to gain a sense of how participants treat unknown or complex business situations;
5. Technological use and perceptions – this section obtained details about the main technologies used by participants in the performance of their tasks and the suitability of those technologies;
6. Organisational perceptions – this section obtained views about the levels of technical and managerial support provided by the organisation, both at a local and international level.

A copy of the interview guide is provided in Appendix 2. Whilst the same set of questions was posed to each participant, elaboration and off-topic discourse was encouraged, with a view to deepen and clarify areas of discussion. The content of each interview was first inscribed using handwritten notes, with particular comments or quotes verbally played back to the participant throughout the session, to ensure comments were recorded accurately. Immediately following each interview, the handwritten notes were then summarised into detailed, typed transcripts, the results of which were then issued to those participants who wished to receive a copy of their transcript for a final review. This process allowed the typed transcripts to be assessed for veracity and provided an opportunity for the participant to add any further post hoc comments they deemed relevant to the interview (Guba & Lincoln, 1982).

All information deemed confidential or commercially sensitive was redacted from the transcripts and all personal content was anonymised in order to prevent identification of

a given participant, stakeholder or interested party. Proprietary system names used within the participating organisation and mentioned by participants were anonymised throughout the interview data. Proprietary system names identified in the transcripts were amended based on the following acronyms:

- OLTP – Online Transaction Processing
- DSS – Decision Support System
- CES – Client Extranet System

The exception to these proprietary system references is Microsoft Office software, which is a universally recognisable application. The transcribed notes taken from each interview represented the formal outputs of the data collection process, which were then subjected to a thematic analysis.

3.6 Data analysis

Following the analytic guidelines recommended by Braun and Clarke (2006), thematic analysis was applied to the typed interview data in order to draw out dominant themes surrounding causalities of fit. The central notion surrounding this analytic method is to infer or uncover inter-related variables from a body of text with a view to develop an analysis that identifies “patterns of meaning” (Braun & Clarke, 2006, p. 15). Themes help form an understanding of the phenomena central to the research and, as such, these themes may develop into a more generalisable theoretical position. Braun and Clarke (2006) suggest a phased approach to theme development, namely: data familiarisation, thematic generation, thematic assessment, thematic definition and report findings. These phases are presented in the following sections.

To assist with this particular analytic procedure, the interview data were collated into a tabular format, with each participant’s response applied and uniquely indexed against each relative question. This grouped layout allowed data associated with individual responses to be analysed with relative ease. A representative sample of this layout is provided in Appendix 3. All phases of the thematic analysis were conducted solely by the researcher-practitioner.

The analysis commenced with data familiarisation, which involved reviewing the data salient to the central question posed. Each response was progressively examined word by word, line by line and then holistically for each interview case, noting specific nouns and verbs to help identify and highlight the various concepts contained in each transcript. Data identified within this process were underlined and salient quotations from participants italicised. Whilst meanings were directly inferred from the raw, transcribed data, the frame of reference used throughout this process was largely deductive, based on the theoretical background exposed by the literature review.

According to Boyatzis (1998) a code, for the purposes of a piece of thematic analysis, is “the most basic segment, or element, of the raw data or information that can be accessed in a meaningful way regarding the phenomenon” (p. 63). A progressive approach was used to generate a set of suitable codes and the process of coding required several separate reviews to complete. The responses identified in the data familiarisation phase of analysis were initially described using a very broad array of codes, which yielded 308 codes. These formative codes were then placed into a Microsoft Excel spreadsheet, with the range of codes sorted and filtered alphabetically for unique records. The use of an alphabetic sort allowed like-named codes to be grouped together and quickly identified. Repeating values were deleted and like-named codes (such as ‘strategy’ and ‘strategic’) were collapsed into a suitably named, single code. The data were further condensed by removing or collating synonymous words, resulting in a total of 88 codes. The final step in code generation occurred when the refined codes were re-applied to the interview data and subjected to a final process of refinement. This process yielded 47 codes which are provided in Appendix 4.

The second phase of analysis involved thematic generation. The ability to generate themes relates to the identification of recurrent patterns in the data. This part of the analytic procedure requires the researcher to explore the various similarities, differences and inter-relationships that exist between codes in order to progressively develop more holistic explanations of the data. Sub-themes were used to identify related codes and themes were used to aggregate sub-themes. This process of data reduction was then displayed within visual mind maps (Braun and Clarke, 2006), using Microsoft Visio as the software application. A total of 5 initial themes were generated during this analytic phase, defined as: Knowledge Work, Implicit Knowledge, Underlying Complexity,

Modular Technologies and Organisational Constraints. The development of these initial themes was individually depicted within a series of thematic mind maps (Appendices 5 to 8).

The purpose of the third phase of analysis, thematic assessment, is to refine the initial set of potential themes based on their respective coherence against related transcript extracts (a so-called “level one” review) and then against the entire body of transcribed data (a so-called “level two” review). The level one review compared specific extracts against matching themes to check for congruence. The theme of underlying complexity appeared to relate to both implicit knowledge and knowledge work. As such, I subsequently collated the data related to experience and relationships into a single code, and proceeded to define sub-themes related to complexity in terms of complexity sources and complexity treatment. These two new sub-themes, together with their related codes, were then associated with a final theme of Implicit Industry Knowledge. Additionally, the initial theme Organisational Constraints generally resonated with the mainly negative remarks concerning international management practices but contradicted positive observations related to local support experienced by participants. As such, the sub-themes of Managerial Indifference from Overseas and Local Managerial Engagement were created to capture these contradictory topics, which were then associated with a more generalised organisational theme called Mixed Organisational Support. These revised themes were then subjected to a level two assessment against the entire body of interview data and no further changes were required. These final thematic definitions are presented for reference in the Findings chapter of this thesis.

The fourth phase of analysis is thematic definition which seeks to accurately define each theme based on its relationship to the central research question posed. Where possible, all themes were described using a suitable noun to define the main phenomenon, prefixed by an adjective to better describe the essential property of that theme. The analysis concluded once these final thematic definitions sufficiently resonated with the central requirement of uncovering causalities of fit; the bulk of the interview data set was covered by the descriptions.

The final phase of analysis requires the researcher to narrate the findings and present the identified themes within a cohesive, single and holistic argument. These findings are provided in a narrative format within the Findings chapter of this thesis.

3.7 Assessment of findings

As a final methodological approach, two critical realist methods, namely, theoretical re-description and retroduction, are used to help direct the assessment of the analytic themes. These assessments are described below and are incorporated within the Discussion chapter.

Theoretical re-description is an abstractive, iterative and reflective process where identified themes are explored and weighed against different theoretical perspectives and explanations (Bygstad & Munkvold, 2011; Danermark et al., 2002). Exposing one's thematic analysis to established theory helps determine the level of sensitivity a particular theme has, which in turn allows better integration between theme and theory.

Retroduction is an inferential analytic method that helps a researcher identify the fundamental conditions required for a phenomenon to exist. Bygstad and Munkvold (2011) suggest that the final stage of causally-based research rests in validating the plausibility or explanatory power of the selected themes or mechanisms by comparing them against contending alternatives. Retroduction is an ideal method to perform this type of analysis. It uses logical inference to regress or work backwards from observation to hypothesis, which is arrived at based on the most likely explanation of causality. Expressed in the terminology of critical realism, this approach allows a researcher to transition from events that affect observable phenomena – apparent within the empirical domain – and to postulate on the generative mechanisms that cause the events to occur - characteristic of the real domain (Sayer, 1992). Traditionally, positivistic research is deductive in approach, whereas an interpretivist stance usually confers an inductive approach to the research topic. Deduction revolves around the development of hypotheses based on existing theory and can be explained as “reasoning from the general to the particular (or from cause to effect)” (Pellissier, 2008, p. xiv). Conversely, an inductive approach to research commences without an initial underlying theory. Inductive research evolves based on observations about a particular phenomenon and

culminates to form an overall concept, theory or set of generalisations. Thus, deduction is theory-affirming; induction is theory-forming. Retroduction is both a variant and combination of these traditional approaches. Ryan, Tähtinen, Vanharanta and Mainela (2009) offer the following definition to describe retroductive inquiry:

“Retroduction implies that researchers look for the conditions or qualities that make the phenomenon beyond what they can immediately see. Retroduction compels researchers to ask not only what happened but what could happen or what hasn’t happened. While this might seem an obtuse or opaque form of reasoning, it can be quite powerful in attempting to understand the nature of an entity.” (p. 14)

This statement imposes a requirement on both the researcher and the reader to mentally simulate an imagined, hypothetical but plausible alternative situation or condition that potentially alters the current state of reality. It is within this research phase that the central causal mechanisms identified within the findings will be explained. It represents the logical, final step from the point of view of critical realist study.

Chapter 4 Description of Research Context

4.1 Overview of the insurance sector

Internationally, the insurance industry represents a vast, competitive market that transacts a wide array of sophisticated products. Within this global market, insurance is classified into two generic product segments - life and non-life. According to figures provided by Swiss Re (2014), the total global premium attributed to the life segment in 2013 was USD 2,608 billion; the global premium for the same period for the non-life insurance segment was USD 2,033 billion.

Discussions about the business of insurance often include the role of intermediated services. According to Bieck, Bodderas, Maas and Schlager (2013), 60% of all insurance transactions occur through an intermediary. An intermediated service provider acts as a conduit or ‘go between’, usually between a buyer and seller, providing business products or services to satisfy the needs of two separate markets. Rothschild and Stiglitz (1976) suggest that the existence of an intermediated role serves to reduce transaction costs and smooth informational asymmetries. Bailey and Bakos (1997) extend this conventional economic definition and suggest four main functions of an intermediary:

- Aggregate the supply and demand dynamics of a market to achieve scale;
- Protect against market opportunism;
- Reduce operating or transactional costs;
- Match buyers and sellers.

When used within an insurance context, the term ‘intermediary’ applies equally to the roles of ‘agent’ and ‘broker’ and, although these terms can be used interchangeably (Cummins & Doherty, 2005), a distinction between these definitions is warranted. A broker, for the purposes of this study, primarily acts in an independent capacity on behalf of clients, which, in the participating firm’s case, are generally large business entities. Conversely, an agent is deemed to be a representative of the insurer. This study uses the term intermediary based on the role and capacity of the broker, as defined above. Additionally, common insurance parlance uses the terms ‘insurer’, ‘underwriter’ and ‘carrier’ interchangeably. These terms reflect the entity that underwrites and issues a contract of either insurance (insurer) or re-insurance (re-insurer). This study uses the

term carrier throughout but, depending on the context where it is used, a carrier may pertain to either an insurance company or a re-insurance company.

4.2 Business model of the participating organisation

The international insurance broking market is currently represented by a relatively small oligopoly of four large corporate firms whose annual revenues exceed USD 1 billion (Yahn, 2014). These firms all provide a diverse and sophisticated array of risk-related financial services to client organisations, which themselves often have a wide international presence. The participating organisation exists within this small group of large multi-national insurance intermediaries, and, at the time of writing, employs about 18,000 individuals in 120 countries. Regionally, the New Zealand operation of the participating organisation forms part of, and reports into, a larger Australasian entity, which in turn, is overseen by a central head office operation in the United Kingdom. A review of the participating organisation's public website, annual reports and promotional materials reveals three areas of key expertise, which are: the provision of intermediated (re)insurance services, specialist risk consultancy services and claims management.

4.2.1 Areas of expertise in the participating organisation

As mentioned earlier, one of the central roles of any intermediated service is to provide 'market matching' capabilities and the participating organisation provides two forms of this intermediated service: insurance and re-insurance intermediation. The insurance intermediary operates between a policyholder who, in the participating organisation's case, is usually represented as a business organisation, and carriers (insurance companies). A re-insurance intermediary operates between insurance companies and carriers (re-insurers). Whilst it is assumed that most people have a basic and general understanding of insurance, re-insurance is arguably a less well known term. Insurance companies usually engage the re-insurance market in order to spread or lessen exposure to a single or accumulated risk. For example, an insurance company may be presented with a single, large underwriting proposition, such as a construction project. The scale of the project may create an exposure that exceeds the normal limits of the carrier's underwriting capacity. As such, the insurer must offset or cede some of this exposure to a re-insurance market, making an insurer a 'cedent' of the re-insurer. Thus, the re-insurance market provides insurance protection for insurance companies.

All intermediated roles operate between buyers and sellers and an intermediated business model is aimed at delivering value to the respective and, often, contending needs of both parties. The buyer or client-side role of an insurance intermediary requires a specific and thorough understanding of the client's business and risk profile, which is then used to formulate a suitable coverage design or insurance or re-insurance 'programme'. Once a programme is designed and a risk management strategy agreed with the client, the intermediary's attention shifts to the seller or carrier-side tasks. An intermediary is required to source insurance markets and products that best reflect the particular needs of a client's insurance programme. Here, the intermediary provides an independent sales and marketing function for carriers. In order to properly assess and price a risk, carriers need accurate information that is salient to the risk presented. A central function of the intermediary is to know what this information is, how best to present it and which carrier markets are best suited to offering competitive terms. As such, the intermediated nature of the supply chain means that carriers need not put additional cost and resource into dealing directly with the client. Instead, the process is better managed by working with selected, intermediated providers, who ought to possess an expert knowledge of their client's overall business and risk profile as well as a deep understanding of the insurance process and market as a whole.

The particular distinction about insurance-related intermediation lies in the duality of the business functions required to satisfy the role. The insurance intermediary's role encompasses both human-centric activities, such as sales generation, negotiation, client representation and advice as well as technical elements, such as understanding a range of customer industries and business models, applying the fundamentals of risk management to these businesses and grounding these within the contexts of insurance, contract and legislative law. The impact of these various disciplines require the practitioner to distil the unique requirements of each client into a set of products that provide appropriate, and usually bespoke, contractual protection.

Most commonly, insurance and re-insurance intermediation earn revenue in the form of commission or brokerage. Interestingly, this payment arrangement is provided by the supplier / carrier of risk and not the consumer or beneficiary of the policy, whose interests the intermediary is primarily meant to represent. It is increasingly common for

intermediaries to forego all brokerage-based payments, especially in the case of singularly large transactions and establish an agreed fee for such transactional services with the client or re-insurance cedent.

The next area of expertise within the participating organisation is the provision of risk-based consultancy and related services. Examples of such services include: financial risk assessment, catastrophe and meteorological modelling, various engineering services that relate to risk (fire hazard assessments, structural and geological / seismic surveys etc.), general risk management strategies, actuarial analysis, business continuity planning and other related advice. Additionally, the participating organisation provides captive and asset management services. Captive management relates to the creation and on-going management of client-specific insurance companies, established to provide insurance protection for the sole benefit of a single corporate client. Remuneration for all these particular professional services comes in the form of consulting fees.

Finally, claims management pertains to the processing, management and advice provided to clients in the event they have a claim or loss. Such a service is particularly significant when a claim becomes contentious between a claimant and carrier. These situations allow intermediaries to advocate on behalf of their clients and, on occasion, use their position to negotiate or leverage a better claims outcome for their clients. Generally, this service discipline is not subject to a specific remuneration model, although certain jurisdictions recognise the function of a 'claims broker'. Such a role will derive fees or commissions based on the nature of the claims and quantum of the claim settlement.

4.3 Insurance policy processes

The business of insurance exists as a means of transferring risk, and the central artefact that defines this transaction is the insurance policy – a written contract of indemnity entered into between a policyholder and carrier. Insurance contracts are fundamentally established on the legal principle of utmost good faith, which requires both contracting parties to act honestly towards one another and provide full disclosure of any information deemed material to the contract. Two essential characteristics of an insurance contract shape the business operations of insurance-related organisations: policy renewability and document generation.

In most cases, an insurance policy remains in force for a finite, fixed period, usually one year, after which it expires. Prior to the expiration date of the policy, the client and the carrier conduct a formal process of renewal, to continue the contractual arrangement. This periodic engagement between the client and the carrier creates the first essential characteristic of insurance-related business - policy renewability. Policy renewal occurs through a series of cyclical process flows, which is collectively referred to as the Insurance Policy Renewal Cycle (insurance cycle).

The second essential characteristic of insurance-related business is document generation; a requirement that stems from the legal nature of an insurance policy. The arrangement of insurance policies requires the generation of particular, evidentiary documentation to one or more parties throughout each phase of the insurance cycle. Insurance is an innately document-intensive business and the arrangement of client-specific insurance contracts makes the generation of significant volumes of related documentation inevitable. Figure 4-1 highlights the various processing phases, the documents generated and the parties involved within the insurance cycle, with each phase described in more detail in the following sections.

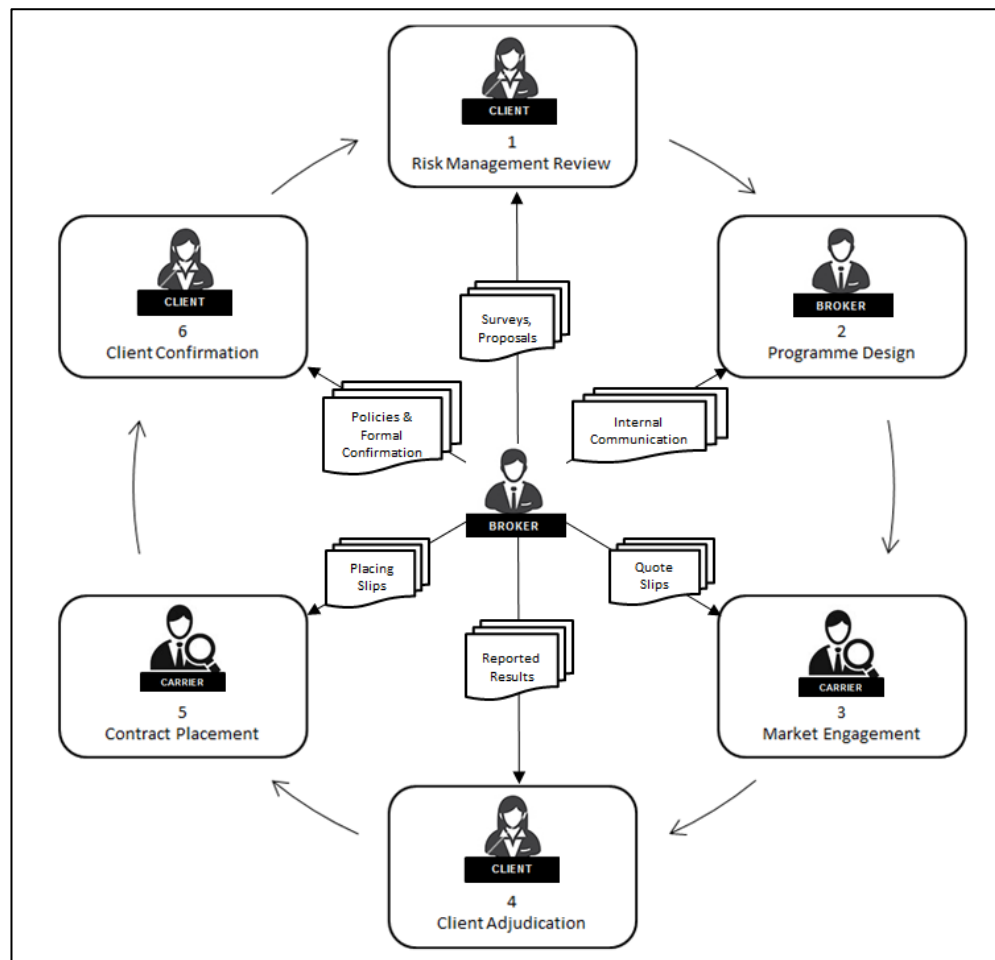


Figure 4-1: Phases, documents & roles in the Insurance Policy Renewal Cycle

4.3.1 Risk management review

To conform to the legal requirement of utmost good faith, policy renewability is contingent upon supplying the carrier market with data that accurately and adequately reflects the client's insurable risks. The risk management review phase commences with a formal assessment of the current risk management and insurance programmes to ensure they meet the clients' objectives and sufficiently cover key strategic and operational exposures. Quantitative and qualitative data relating to these risk management themes are captured in information-gathering documents such as questionnaires, proposal forms or surveys, the results of which provide two essential outputs: valid, accurate and current data for carrier underwriting and the derivation of policy limits, which reflect the insured values nominated for each insurance product the client requires. This data-gathering exercise is thorough and often time-consuming. In many cases a formal risk management approach is utilised to identify and analyse all aspects of the business operation, including business interdependencies, planned activities, geographical presence, and so on.

In situations where a new client is introduced to the participating organisation, or where no prior history or previous documentation exists for that client, the intermediary relies on product-specific templates, in the form of Microsoft Word or Portable Document Format (PDF) files, to create an initial portfolio of client documentation suitable for data-gathering. Using a mix of client-specific data, generally accepted information pertinent to the nature of the client's business and the intermediary's implicit knowledge of business risk and insurance, these generic documents are manually modified using word processing software to better reflect the client's specific needs.

Most commonly, where the client has an existing relationship with the firm, the intermediary is able to rely on previous documentation, generated during the previous renewal processing cycle. This process involves workers referring to the documentation generated in the prior year's renewal, copying these files and altering salient information within the copied document to reflect current policy terms, conditions and values. These data-gathering files are usually sent to the client as a set of attachments to an electronic mail message; in some cases, the file may be issued as a physical document using traditional postal services. The intermediary will usually arrange to work through these documents in conjunction with the client, often in person, at the client's main place of business. In doing so, the intermediary may draw out additional areas of potential operational exposure not revealed by the data-gathering files, and discuss potential product, market and purchasing strategies with the client.

The data gathered during the risk management review phase are intended to provide carriers with a perspective of risk. The term risk in this context refers to the probability or likelihood of a particular event occurring as well as the severity or extent of such an event. The nature of a risk is derived from the identification of essential hazards to which the client business is exposed. The term hazard in underwriting terms refers to a peril or threat that has the potential to affect people, property or the environment. As such, identified hazards constitute the variables required for an underwriter to assess the level of risk and derive a rate of premium that meets the cost of that risk. Those unfamiliar with the business of insurance may infer that these data provide a degree of predictable underwriting consistency, where the same hazard and risk data presented to two separate underwriters would generate largely similar underwriting outcomes. This

is often not the case, with underwriting decisions driven by various subjectivities including human perceptions about risk, organisational cost drivers, allocation of capital and the various individual re-insurance considerations an insurance carrier might be subject to. Figure 4-2 depicts the main process flows associated with the risk management review phase.

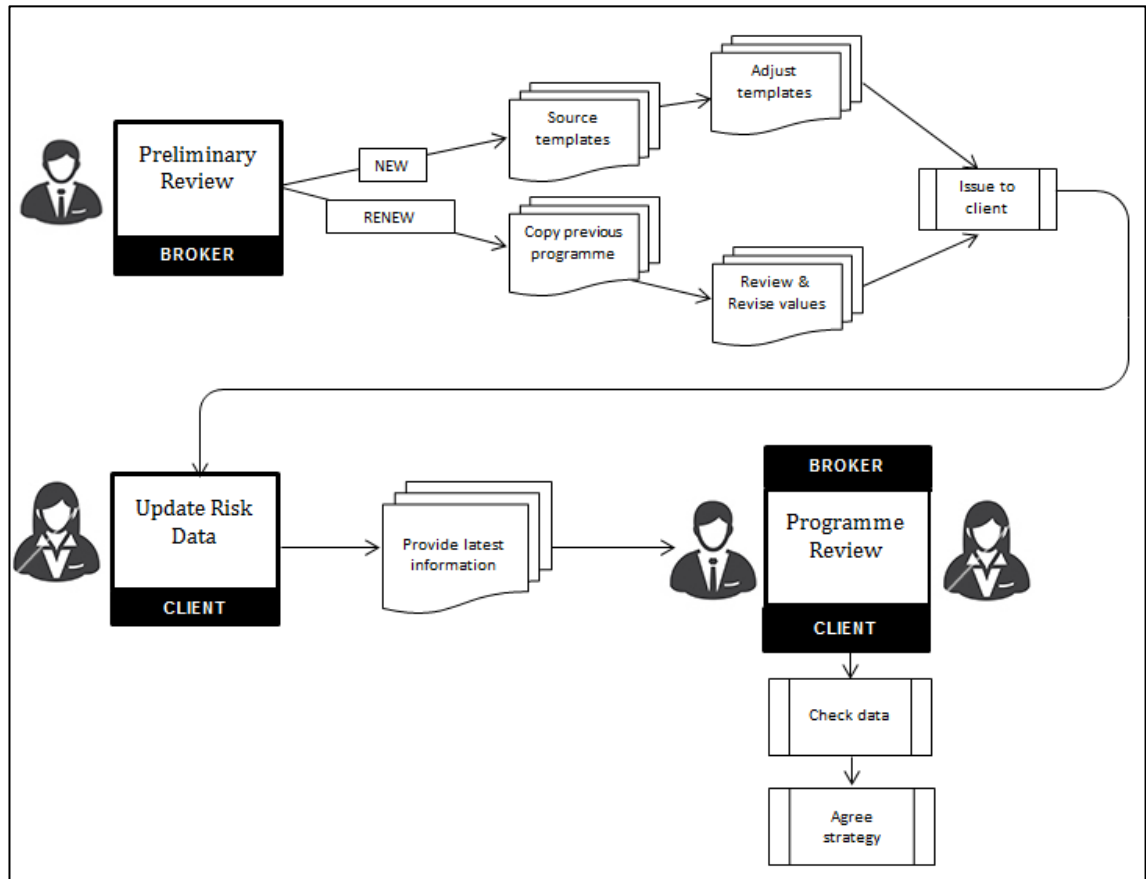


Figure 4-2: Process flows of the risk management review phase

4.3.2 Programme design

Once the data are collected, the intermediary is then tasked with coverage or programme design – a process that combines the data taken from the information gathering exercise, an understanding of the clients business and risk management strategy and a thorough knowledge of the most appropriate carrier markets to present this information to. Additionally, the intermediary may engage his or her network of organisational contacts to assist with this phase of the insurance renewal, depending on the nature or scale of the client's business operations or where the type of the insurance policy falls outside the intermediary's area of expertise.

Another factor that drives the programme design phase is the extent to which a client's requirements can be adequately met using a standard product solution. Certain insurance products identify with relatively invariant processes or require low data capture requirements and thus lend themselves to standardisation. Such products are generally referred to as 'facilitised' products. As a rule, facilitised products are singular and generic in nature, covering a defined set of perils that can be broadly applied to a large number of clients without the need to vary underlying policy conditions. The generic nature of facilitised insurance products stems from the ability to classify and standardise the hazard and risk variables required for underwriting, obviating the need for an individual underwriting assessment. Facilitised products are largely price sensitive and usually have application to personal insurance requirements or small scale, simple business organisations. Additionally, such products usually have a pre-defined carrier market assigned to them, all of which simplifies or obviates the need for an in-depth assessment of programme design or market engagement. However, the majority of clients that the participating organisation concentrates on are complex, diverse business operations which rely on the services of an intermediary to ensure their respective insurance programmes are well-designed, customised and effective. These larger and more complex businesses base their buying behaviour on a wide mix of metrics, including the quality or extent of cover offered by each carrier, the carrier's ability to service and efficiently settle claims, carrier appetite for the risks presented by the client's business model and the solvency or financial strength of the carrier. Price for the coverage is also a factor but it is not the singular determinant in the eventual decision to purchase.

Once an insurance programme is formalised, the intermediary is tasked with obtaining insurance 'terms', which refers to the contractual conditions and pricing available from insurance markets. Based on the renewal strategy agreed with the client, the intermediary may elect to 'remarket' some or all of the client's insurance programme – a process where a range of suitable carrier markets are approached and invited to provide competitive, alternative insurance terms. Remarketing occurs periodically, usually once every three to five years, and is done to check the pricing and efficacy of the current insurance programme. This strategy of periodic re-marketing ensures that a high level of competitive tension is maintained within carrier markets and provides a reasonable assurance that successful carriers will receive the benefit of premiums for a

longer period than just one year. The likelihood of longer term client fidelity usually results in more favourable initial terms. As such, the renewal cycle most commonly involves engagement and negotiation with the incumbent carrier or carriers. The programme design phase is depicted in Figure 4-3.

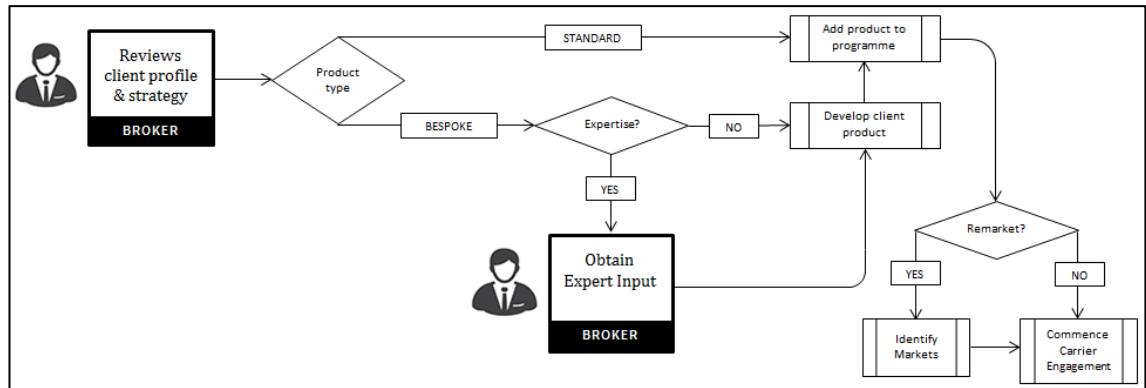


Figure 4-3: Process flows of the programme design phase

4.3.3 Market engagement

The intermediary engages with a selected insurance market by providing an initial written ‘offer’, using a formal, structured document called a quotation slip (slip). A slip represents a ‘short form’ or abbreviated version of the underlying insurance product that needs to be underwritten and stipulates the desired levels of cover, such as policy limits and deductibles, as well as highlighting particular contractual conditions that are weighted to favour or better protect the client’s insurable exposures. An exemplar of the slip is provided in Figure 4-4. The current process in the participating organisation requires the intermediary to manually populate policy-related data into slip templates, with this task repeated for each policy represented within the client’s insurance programme. The slips, together with relevant underwriting information gathered in the risk management review phase are then issued to carrier markets for the purposes of obtaining and negotiating terms that meet the client’s insurance needs.

Very often, carriers will respond to the slip with counter offers that alter the initial request by reducing or excluding particular conditions or events. As such, the market engagement phase is often negotiative and can be quite recursive, especially when dealing with a competitive situation. The back and forth between intermediary and carrier markets continues until the intermediary feels s/he has achieved satisfactory terms – an agreeable level of competitive tension that meets the needs of the client and

provides an equitable level of premium for the coverage offered by the carrier. Figure 4-5 provides the central processes associated with this phase of the insurance renewal.

QUOTATION SLIP	
Original Insured:	<i>Client Name</i> and / or Subsidiary Companies and / or Companies for which they have Management Control and Joint Ventures, as now or hereafter constituted, formed or acquired and as more fully defined in the Policy Wording
Named Reinsured:	<i>Reinsured Name</i>
Period:	From <i>dd mmmm yyyy at hh hours locale</i> To <i>dd mmmm yyyy at hh hours locale</i> at the location of the Property Insured and any subsequent period for which the Original Insured shall pay or agree to pay and the Insurers shall agree to accept a renewal premium.
Description of Business:	All activities carried out by the Original Insured including but not limited to the following: <i>Full description of business activities</i> Any other activity in which the Original Insured lawfully engages consequent upon any purchase or acquisition by it, or as approved by the lead Reinsurer.
Sum Insured:	<i>Currency Sum Insured</i> any one loss or series of losses arising out of any one event but in the annual aggregate in respect of Earthquake, Tsunami, Volcanic Eruption, Hydrothermal Activity, Subterranean Fire and Fire following The loss limit is restricted to one paid reinstatement of _____ and subject to reinsurer agreement and availability in respect of non-earthquake perils, the earthquake Perils Being Listed In The Annual Aggregate Above.
Sub Limits:	Deemed to apply to any one loss or series of losses arising out of any one event and in excess of relevant deductibles. Section 1 - Material Damage Capital Additions - Each and every or any one loss per addition Expediting Expenses Landslip and Subsidence Machinery Breakdown Construction Risks Extinguishment and Mitigation Expenses Claims Assessment Acquired Companies – Each and every or Any one loss per Acquisition Transit Debris Removal Search and Location Costs Section 2 – Business Interruption Additional Expenditure

Figure 4-4: Exemplar of a Quotation Slip

Clients whose business operations are large and complex may require the intermediary to engage several different carriers to jointly participate in underwriting a single insurance policy. This process of carrier syndication may occur in two dimensions:

vertically and / or horizontally. For example, a client who owns high value assets may need to engage with a series of carriers that underwrite vertical ‘layers’ of the insured assets – carrier A underwrites asset values from zero to 1 million; carrier B underwrites the next layer from 1 million to 10 million; carrier C underwrites from 10 million to 50 million and so on. Additionally, carriers may be syndicated horizontally, with multiple carriers underwriting a proportion of each layer – an arrangement referred to as ‘co-insurance’. These forms of carrier syndication may occur jointly or separately within a given insurance programme of sufficient scale, the arrangement of which requires considerable levels of both negotiative and coordinative skill on the part of the intermediary.

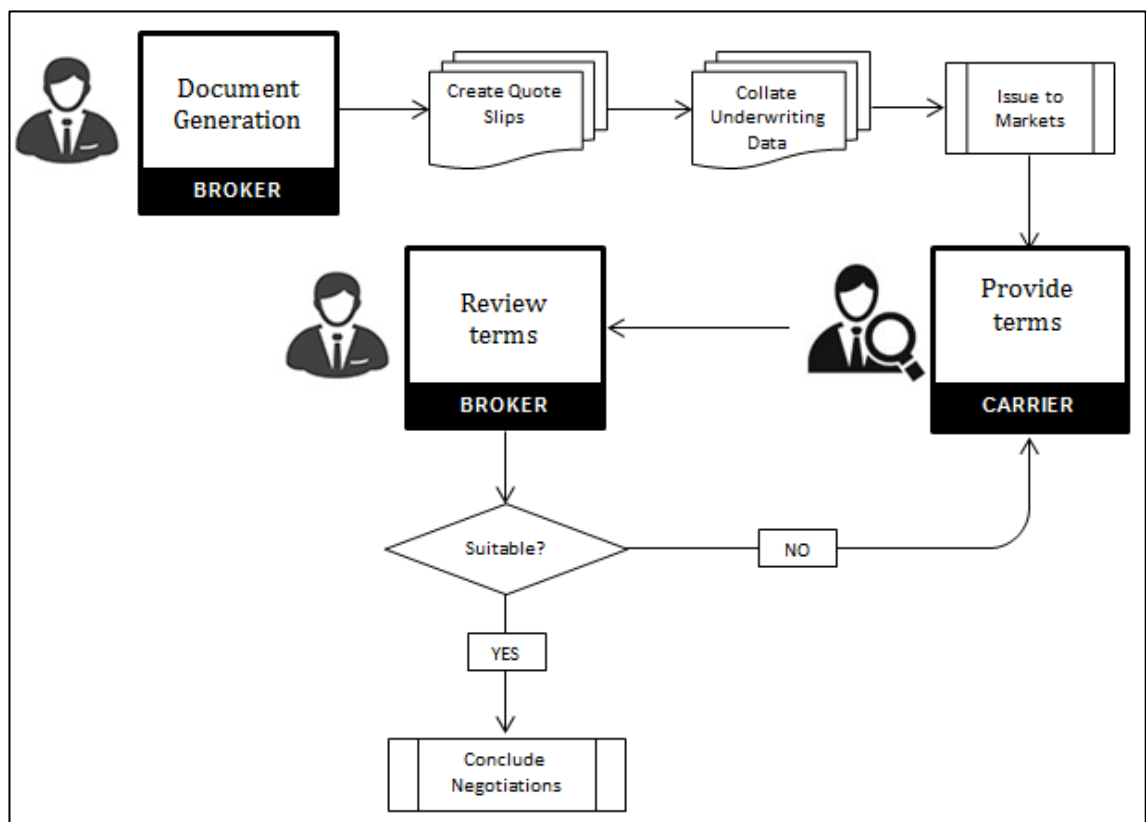


Figure 4-5: Process flows of the market engagement phase

4.3.4 Client adjudication

Having engaged with carrier markets to achieve satisfactory insurance terms, the role of the intermediary shifts back to the client, assisting them in the process of adjudicating the most favourable set of options, based on the client’s risk profile and organisational objectives. To achieve this, the intermediary must pull together all salient aspects of the market responses and present this information back to clients in an understandable but thorough manner. The objective of the adjudication phase is to highlight to the client the

comparative differences between competing insurance terms or indicate where material differences have occurred in the current insurance arrangements and the significance of such differences. The adjudication phase allows a client to make an informed decision about their insurance programme and thus provide express agreement to the intermediary to finalise the necessary contractual arrangements. Figure 4-6 incorporates the main processes associated with this phase of the renewal cycle.

4.3.5 Contract placement

Once a decision has been made by the client, the intermediary re-engages with the selected, successful carriers, requesting them to ‘bind’ or ‘place’ cover, based on the terms established during the market engagement phase. Just as the market engagement phase uses a quotation slip to communicate the proposed short-form policy requirements for a client, a placing slip is the document used to evidence the agreed limits, terms, conditions and pricing established during carrier negotiations. Both the quotation and placement slip forms are essentially the same document, the main difference being the quote slip contains initial or proposed policy terms and the placing slip contains final and agreed terms. The issuance of a placing slip by the intermediary to the carrier or carriers is a request to bind an insurance policy, the act of which represents a contractual offer; carrier agreement to this request represents acceptance and, thus, formalises the arrangement, bringing into existence a legally enforceable insurance contract. Figure 4-6 incorporates the main processes associated with this phase of the renewal cycle.

4.3.6 Client confirmation

The final phase of the insurance renewal requires the intermediary to issue confirmation of the established insurance arrangement to the client. This confirmation will usually be comprised of several items of evidentiary documentation, including a formal letter, which outlines the main features of the contractual arrangements made on behalf of the client. Additionally, where a single policy or entire programme has experienced significant change to underlying contractual terms or conditions, the intermediary will usually issue a complete policy wording to the client. Alternatively, where the underlying contract remains intact, an insurance schedule is produced, which only reflects the changes to the insured limits and values. Other documents that may be issued in the confirmation phase of the insurance renewal include an insurance register,

which summarises an insurance programme and invoices for the agreed premium, fees and other charges associated with the provision of the client insurances. Figure 4-6 incorporates the main processes associated with this phase of the renewal cycle.

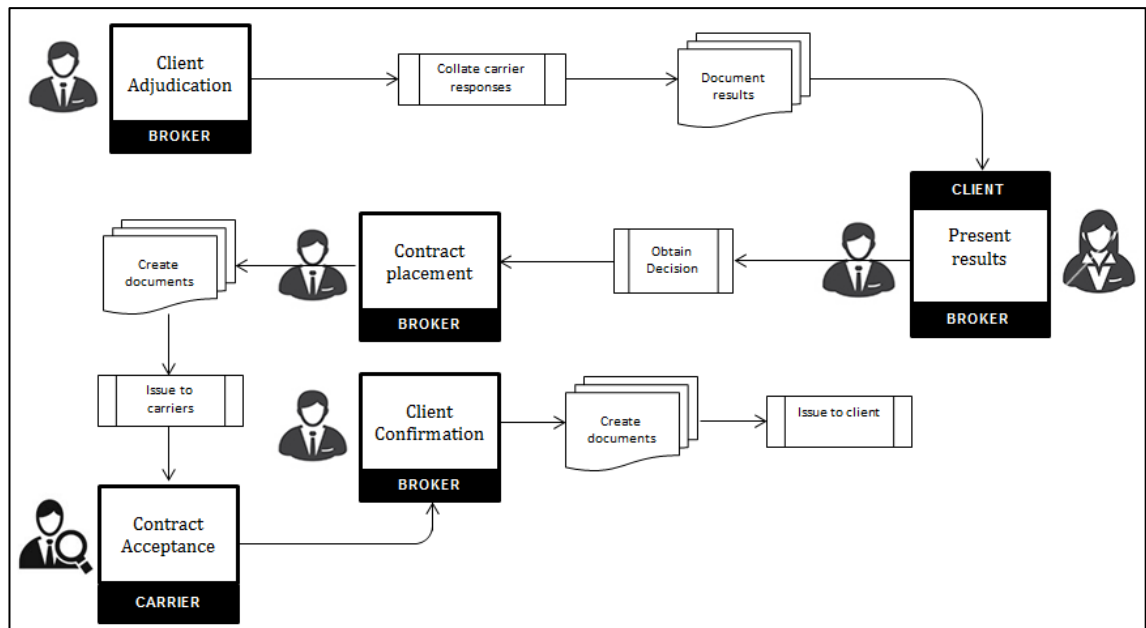


Figure 4-6: Combined process flows of the client adjudication, contract placement & client confirmation phases

4.4 Summary of the research context

The participating organisation acts as an insurance intermediary, whose business model revolves around representing the interests of mainly large and complex corporate firms. This representation demands a particular and expert skill set, with experienced practitioners required to understand the highly nuanced needs of individual businesses, a capability to arrange client-specific insurance contracts and the ability to foster strong, ongoing internal and external relationships. When viewed as a single artefact, an insurance contract is a complex and multi-dimensional financial instrument, which requires the involvement of specialist, expert knowledge for its creation, development and perpetuation. The essential complexity of such knowledge work relates to the legal content associated with the policy as well as its bespoke design. Whereas the majority of other financial instruments, such as shares or loans, are essentially numeric in nature, the insurance policy is defined mainly by words, in the form of contractual terms and legal definitions. To a lesser extent, the insurance policy has a numeric component to it, represented as limits, deductibles and premium, but its essential form is textual. Moreover, the nature of the insurance policy influences the cultural and organisational

conditions within insurance-related workplaces. The organisational operations of insurance-related businesses are strongly influenced by the renewability of insurance contracts as well as their fundamentally legal constitution. The renewability of a policy creates a series of relatively predictable, cyclical and sequential workflows or phases; the legal nature of a policy requires the generation of particular, evidentiary documentation within each phase. How these phases, processes and tasks are individually performed and perceived, relative to their association to Task-Technology Fit theory, are expressed in the following Findings chapter.

Chapter 5 Findings

5.1 Chapter outline

As established within the Methodology chapter, data for this study were obtained from various knowledge worker roles using semi-structured interviews for the purposes of performing thematic analysis. This chapter articulates the reasoning used in the development of the codes, sub-themes and themes that emerged from the collected data and the subsequent analysis. Four themes were generated from the analysis, namely: mediated knowledge work, implicit industry knowledge, context sensitive technology and mixed organisational support. Each theme represents a broad, theoretical concept and exists as a topic which may highlight certain causal conditions of technological fit or misfit. Each theme consists of sub-themes, which group together collections of related codes. The codes themselves represent the lowest order of data abstraction, where meaning is taken from the textual data and translated into a singular, codified term or phrase.

The structure of this chapter is outlined as follows: each theme is introduced as a central subject of discussion and a table of related codes and sub-themes is provided to help summarise the analytic findings. Using sub-themes as the frame of reference, salient data taken from the interview transcripts are used to progressively discuss and explore the construction of each code, with each code placed in square brackets immediately following each data excerpt. I provide contextual explanations where coding divergences show up in the analysis and mind maps are used to help graphically represent the results of each theme.

5.2 Theme One - Mediated knowledge work

The theme of mediated knowledge work indicates a work environment where similar tasks performed within the participating organisation can vary markedly. Overall, knowledge work tasks are layered, multi-faceted and mediated by a myriad of factors, including the existence of various underlying contingencies and complexities. The fluidity and emergent nature of knowledge work generally applies across all roles involved in the analysis. However, the data exposes three broad groupings of knowledge work, which are presented as sub-themes and are categorised as personal judgement,

structured work attributes and unstructured work attributes. The sub-theme of personal judgement pertains to the nature of individual decision-making that knowledge workers engage in as they perform their roles. Indirectly, the theme of personal judgement references the notion of autonomy, which is an important and often-cited component in the knowledge work literature. The sub-theme of structured work attributes identifies the prescriptive, common and predictable task characteristics that occur, either in whole or in part, in many knowledge worker roles. Conversely, the sub-theme of unstructured work attributes captures the emergent elements of knowledge work including creativity, variety and expertise encountered by various knowledge workers in the participating firm. Table 5-1 presents the development of the mediated knowledge work theme, including its constituent sub-themes and codes.

Table 5-1: Development of Mediated Knowledge Work Theme

Codes	Sub-themes	Theme
Delegated judgement; Interpretive judgement; Relative judgement;	Personal Judgement	Mediated Knowledge Work
Routines; Standard frameworks; Predictable with external interruptions; On-call Availability; Solution-focused interaction; Occasional novelty; Transactional relationships;	Structured Work Attributes	
Varied work; Strategic consultation; Creativity; Multiple solution pathways; Specialised expertise; Intensive client engagement;	Unstructured Work Attributes	

5.2.1 Sub-theme: Personal Judgement

All participants interviewed for this study indicated that their roles require a level of personal judgement or discernment to execute their tasks. When describing particular business cases that require personal judgement, several subtle distinctions emerge from the language that participants' use. These varied perceptions of judgement-based tasks helped form related codes. For example, the data suggest that personal judgement can occur as a function of mutual trust, created over time with the client. The account director indicates this form of judgement as follows: "The client will usually trust my call on particular things... but this arrangement takes time to build..." [Delegated judgement]. By delegated judgement, I refer to certain confidential decision-making

responsibilities a client hands over to his or her trusted advisor. This perspective indicates the provision of mentoring, guidance or direction, where the client defers to the expertise of a trusted advisor to make prudent decisions on the client's behalf. This trust-based relationship correlates to the characteristic of deep client engagement that is evident within certain role attributes. As my analysis turned to more transactionally-focused roles, such as the specialist and retail insurance broker, the language related to judgement-based tasks altered slightly. In these cases, the data seem to describe judgement as the provision of an optimal recommendation when confronted with a range of potential options, all of which have an interpretive element to them. The specialist broker describes this form of judgement as:

“...comparing the relative merits of certain policy limits and deductible options. Being asked for recommendations. We have to look for discernible differences. We also have to adjudicate the most suitable markets and experience largely determines this. We just know that carriers (insurance companies) will have strengths in certain areas and we match these up with what the client needs”.

[Interpretive judgement]

The data provided by the corporate broking role reinforces the comparative and subjective aspects of interpretive judgement-making: “You have to decide which market or solution best fits with the client requirements. There is a fairly high level of personal judgement involved” [Interpretive judgement]. This form of judgement-making presumes that the knowledge worker has a broad and up-to-date understanding of candidate insurance markets which are capable of adequately underwriting the client's risk requirements. An element of experience is inferred from this perspective, an assumption that appears to be validated in related comments made by the commercial retail insurance broker. When asked if his role requires judgement or decision-making tasks, he reflects: “We often need to think deeply about a client's business, highlighting exposures, and dig deep into their risk profile. That sort of analysis comes down to our views and judgement – it is based on your experience” [Interpretive judgement].

Another variation of personal judgement occurs in the accounting role where numeric thresholds are used as the main determinant to form what I call relative judgements: “\$2 is less concerning than \$2,000. We make judgements based on what we deem to be

material” [Relative judgement]. Based on my interpretation of these data, an essential difference emerges between a relative judgement and an interpretive one: a relative judgement can be objectively stated and is often more concrete or absolute in nature. Accounting and finance roles are concerned with the treatment of numbers, which comply with strict arithmetic rules and consistent logical comparisons. Conversely, interpretive judgement is entirely subjective. The business of insurance is denominated in words, which must be understood and translated individually and mutually agreed between all contracting parties. The provision of insurance contracts requires an understanding of complex business scenarios, imagining contingent events or exposures that might adversely affect these businesses and putting in place protective legal contracts that lessen the effect of such exposures. Given two insurance intermediaries confronted with the same business issue, the nature of an interpretive judgement is likely to yield different results. Just as importantly, given two differing interpretive judgements related to the same set of conditions, it may be difficult to assess a superior judgement.

In sum, the sub-theme of personal judgement highlights the levels of discretion and autonomy required to perform tasks in knowledge work roles. The findings also indicate that not all judgement-making tasks are equal in knowledge work environments.

A hierarchy of judgement-based tasks seems to exist in the participating firm. In this hierarchy, higher-order delegated judgements occur because of the trusted and privileged position occupied by certain intermediated roles. An intermediary acts as an agent of a client organisation and is often privy to certain business confidences. Clients entrust potentially sensitive information to their risk advisors, enabling the intermediary to unilaterally formulate and enact suitable protective strategies on their clients’ behalf. Interpretive judgements occur as mid-order judgement tasks, requiring knowledge workers to synthesise, assess and compare business information in order to form subjective, value-based recommendations. Relative judgements present as lower-order judgement tasks. These judgement types are objective, ordered and mainly numeric. Relative judgements can be defined in discrete and absolute terms, allowing outcomes to be ranked, using comparative expressions such as ‘more’ or ‘less’, ‘better’ or ‘worse’ or other similar binary terminology.

5.2.2 Sub-theme: Structured work attributes

The data suggest that certain knowledge workers regard their roles, or at least significant components of their role, as relatively invariant and largely standard. Such roles tend to emphasise high levels of structure and routine. As an example of this structure, the tasks associated with the accountant's role are tied to strict monthly reporting deadlines, where each task is pre-defined and other periodic deadlines related to regulatory reporting are diarised: "We have a monthly timetable prepared in advance" [Routines].

Other client-facing roles express the notion of role structure in terms of a standardised, prescriptive set of processes that they abide by. The specialised broker describes this aspect of her role as follows: "We work within existing policy frameworks. You are matching things up to pre-existing boxes. It's not like we have to create brand new insurance products" [Standard frameworks]. The notion of standard frameworks refers to a diagnostic capability which allows an individual to assess the type of task or business issue in front of them and, once identified, determine how the task can be treated, named or categorised, based on a selection of particular work methods. The re-insurance broking role alludes to this work method as follows: "It starts with a description of all business activities and we need to be able to categorise this into proper underwriting classifications or occupations" [Standard frameworks]. Comments from the specialist broker further reinforce this deductive approach to task treatment. When asked how she would approach a new client that she had no previous connection with or knowledge of, she replies: "I'd ask questions based on their industry and then work down from there. Determine what they do and see if they fit into some sort of classification" [Standard frameworks].

The data indicate that a certain level of commonality is shared across all knowledge work roles in the participating organisation. All participants suggest that their work is largely ordered and generally predictable, with moments of unplanned interruption occurring from random events. The causality of such predictability relates to the underlying time constraints tied to the actual work itself. For accounting-based roles, the requirement to provide a monthly set of financials drives a specific agenda. As the accountant observes: "We have a monthly timetable prepared in advance, so we can plan for submitting GST or FBT (regional tax) returns, that sort of thing. But there are

things that crop up that are quite ad hoc that require problem-solving” [Predictable with external interruptions].

For client-facing roles, the time factors relate to the management of client insurance programmes – which are assumed to be governed by the expiry dates that apply to each insurance policy. As observed by the accountant role, this work predictability is often punctuated by unplanned events or external interruptions. As the national accounts manager explains: “I always have a plan. I use the electronic diary and check it to assess the next days planned activities. But that can turn to custard in a second – usually as a result of a pressing client issue” [Predictable with external interruptions].

This explanation offers a somewhat guarded affirmation of work predictability. It comes with the caveat that a well-planned day can change at a moment’s notice. Client needs usually drive these unstructured, reactionary events and the intermediated nature of client-facing roles requires that such demands be met as a priority. The emphasis placed on meeting a client need in a timely fashion highlights a requirement of continual and immediate availability, which spawned a related code within my analysis, namely *on-call availability*. Comments attributed to the commercial retail broker reinforce the aspect of availability and repeat the semi-predictable nature of the role: “Because of e-mail, I am more accessible and therefore there are a lot more interruptions [On-call availability]. So we juggle between dealing with new issues and catching up on planned tasks” [Predictable with external interruptions].

Additionally, all participants engaged in client-facing tasks indicate that their role is essentially that of a ‘solution provider’, offering risk-centric products and services to corporate clients. According to a senior corporate broker, the work involves “client and carrier (insurance company) interaction to provide an insurance solution to the client” [Solution-focussed interaction]. The captive management consultant repeats the notion of providing client-centric solutions, as follows: “As mentioned, the role has expanded into consulting tasks. Accounting work can be generally defined but consulting requires a client-specific solution. They (clients) use our services where conventional insurance may not be the best fit” [Solution-focussed interaction].

Data associated with structured work attributes allude to a lack of regular creative input required to perform the role. This notion is borne out by data supplied by the corporate broking role. When asked if the role involves a high level of creativity, the corporate broker replies: “Not really. Very little in the way of creative elements. It’s not like we build anything brand new. It is all about relationships – usually. You do get some things that are ‘out-of-the box’, where you say ‘you want to do what?!’ It might be difficult for someone new to the industry” [Occasional novelty].

Another aspect that emerges from the data is the transactional nature of more structured roles. This aspect of the data suggests that some client-facing roles are primarily geared towards the provision of insurance products, with a minimal level of added value service or advice. The retail broker states: “I have transactional clients – they just want good products at a fair price” [Transactional relationships].

5.2.3 Sub-theme: Unstructured work attributes

In contrast to the data associated with standardised, structured work attributes, unstructured knowledge work points to a highly personalised and client-specific service offering associated with deep levels of client engagement. The notions of consultation and task variety come through strongly in the findings, as indicated in the data provided by the captive management consultant as follows:

“The tasks are now considerably more varied, with no more than 25% of my time spent on any one task. The role has become consultative. It is varied, highly unique and every case is different. There are common things with the role – it deals with risk and insurance. The variance or diversity of work comes down to the occupation and location of the client”.

[Varied work]

The account director repeats this notion succinctly: “You cannot put a pin on a customer. The work is so varied” [Varied work]. I was struck by the turn of phrase used by this participant in this particular sample of data. I interpret the expression putting a “pin on a customer” as either assigning a label to a client firm or, possibly, mentally pinning the client into an imaginary board, thus specifically locating it in a fixed position. The inference drawn from this interpretation is a caution against defining a

client business in simplistic, singular or overly generalised terms. Client organisations can shift dynamically and, as agents representing such organisations, insurance intermediaries must anticipate and accommodate such changes to business conditions.

When describing the nature of the role and work performed, the account director emphasises the strategic and co-coordinative aspects of his work: “There is a lot of co-ordination and strategy involved with the engagement with the client” [Strategic consultation]. The same participant goes on to deepen the strategic and consultative elements related to his work:

“I do not talk about insurance. I talk in terms of exposure, business operation, concerns about risk, ‘what keeps you up at night’. Not everything relates to insurance. A dialogue with the client will allow these things to emerge. I then have to translate these needs into a proper strategy aimed at addressing those needs. Talking and relationships are vital”.

[Strategic consultation]

Additionally, and in contrast to those roles that align with a more structured, standardised level of knowledge work, a high level of creativity is expressed by certain participants. The data indicate that consultative roles require a creative approach to formulating suitable client solutions. Here, the account director comments: “...there are no off-the-shelf solutions for our clients” [Creativity]. Relatedly, the national accounts manager observes that: “client solutions are not vanilla-solutions” [Creativity]. Similarly, other roles that provide a high degree of client-centric specialism note the modularity and variation their job entails - a work dimension that often leads to multi-final solutions or outcomes. The re-insurance broker summarises these aspects of her role in the following way:

“Sometimes our clients do not know what they need. They know what they can retain themselves but do not know how best to structure their re-insurance arrangements. The most suitable arrangement may require an excess of loss, proportional layers and so on. There are many ways to structure an RI (re-insurance) programme”.

[Multiple solution pathways]

In general terms, unstructured knowledge work is highly case-specific and requires particular and specialist skill sets. When describing what she does, the captive management consultant emphasises the high level of international tax expertise and legislative knowledge required to perform her role:

“The role also requires managerial oversight of published account production – perhaps 15% of the role is taken up with these duties. There are our own compliance requirements to attend to, such as regulatory filings for clients, checking to ensure legislative compliance is maintained. The role requires knowledge of the laws and tax regimes of various countries, including New Zealand, Australia, Vanuatu, Bermuda and Singapore”.

[Specialised expertise]

Compared to the roles which provide more standardised solutions, the data indicate that a higher level of intensity and client interaction occurs amongst actors who occupy more consultative roles. For example, the account director highlights the daily interaction between himself and one of his clients: “Day to day service. It is service-heavy. I am at the clients premises two to four times a week. The renewal strategy lead-in time for this client starts six months out from the renewal date” [Intensive client engagement].

To summarise, whilst there are certain common attributes that are shared amongst knowledge worker roles, knowledge work in the participant organisation appears to graduate, based on the nature of the underlying client relationship. The data indicate that larger, corporate clients require deeper levels of engagement, strategy and consultation. Such firms require specific, solution-making capabilities which cannot be categorised or defined by a formulaic relationship. By contrast, smaller firms, or clients that concentrate on providing a singular, professional service, require a more transactional offering, consisting of suitably arranged products and some related advice, which can be formulated and classified into standardised practices, operational policies and procedures.

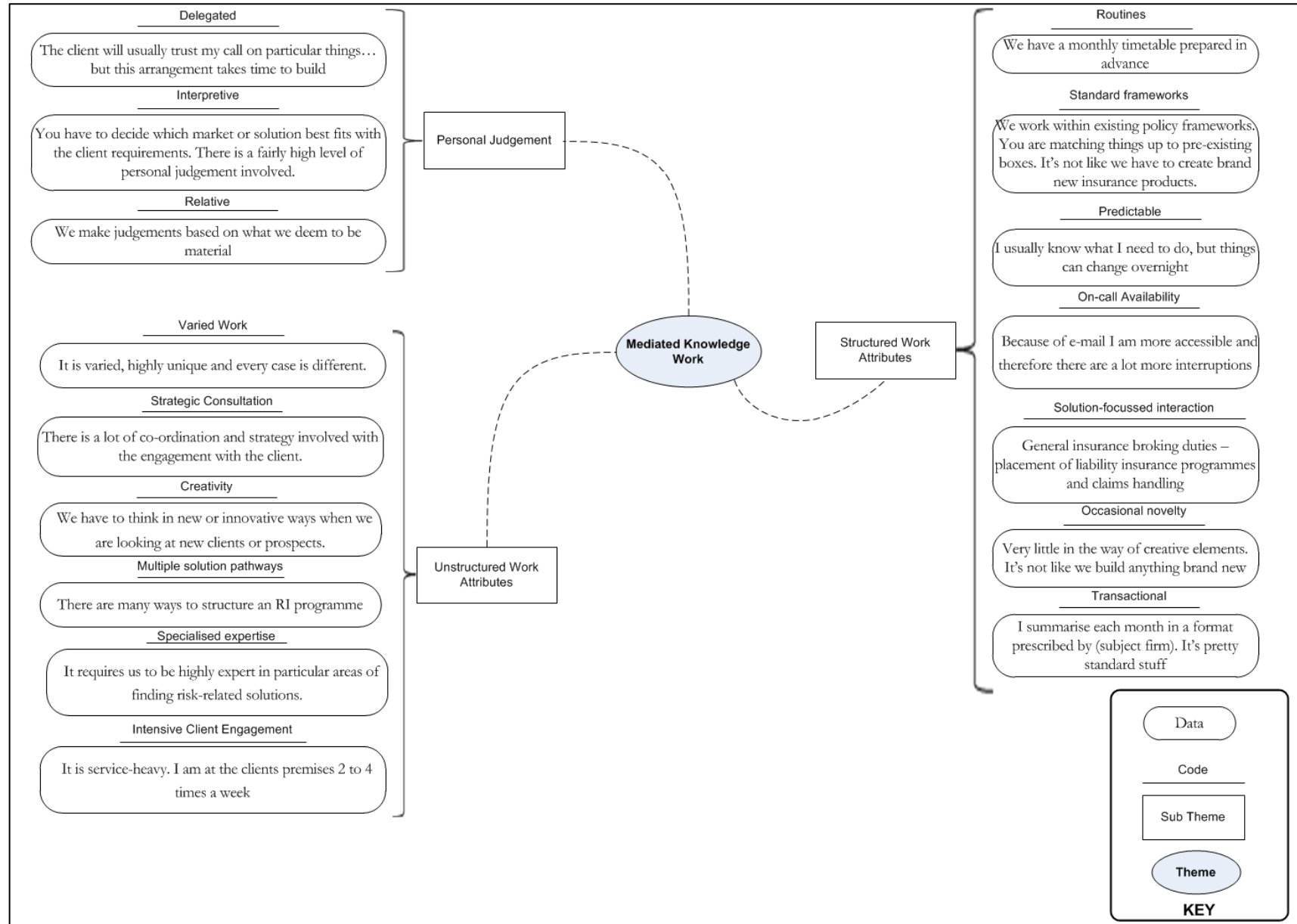


Figure 5-1: Thematic Map One – Mediated Knowledge Work

5.3 Theme Two - Implicit industry knowledge

The findings suggest that a great deal of job know-how is contained in the minds of individual actors within the participating organisation. The theme of implicit industry knowledge developed from a series of questions that sought to understand how knowledge workers perceive complex business situations and how such complexities are approached and resolved.

Data related to implicit industry knowledge are grouped into two sub-themes – complexity sources, which reflect the objective and underlying drivers of job complexity and complexity treatment, which explores the subjective, personal aspects of job know-how and identifies the manner in which knowledge workers navigate and resolve external complexities. Table 5-2 presents the development of the implicit industry knowledge theme, including its constituent sub-themes and codes.

Table 5-2: Development of Implicit Industry Knowledge Theme

Codes	Sub-themes	Theme
Hazards; Complex business models; Business diversity; Contingent complexities; Client amenability; Cumbersome systems; Informational loads;	Complexity sources	Implicit Industry Knowledge
Intuition; Background knowledge; Established, trusted networks; Informal collaboration;	Complexity treatment	

5.3.1 Sub-theme: Complexity sources

Complexity sources are defined as those events or contingent conditions that affect the tasks of a knowledge worker, the requirements of which are resolved through the expertise and actions of knowledge workers. The first examples of these sources are a client's exposure to hazardous activities, the physical construction of particular materials and the geographic location of the client's operation, all of which act as significant complexity factors - an unsurprising outcome considering the core business of the participating organisation deals with the provision of insurance. Discussing one of his clients, the corporate retail broker states: "There are some innate technicalities associated with this industry that make it complex. Also, the location and geography play a big part. Natural hazards like earthquake, wind storm, flooding all affect hydro-

electric dams and wind farms.” [Hazards]. The re-insurance broker role echoes these sentiments: “The dairy industry is tricky due to the use of exposed polystyrene used in the majority of their cool stores. This type of construction material represents a high risk. Areas where there is a high earthquake exposure are also difficult to arrange” [Hazards].

As I progressed through the data, looking for sources of knowledge work complexity, it became clear that certain external complexities can occur because they are either naturally complex or can become complex. To illustrate these forms of complexity sources, I derived two codes: *complex business models*, which indicate the presence of a firm operating a highly technical business model or conducting business within a complicated market, and *contingent complexities*, which indicate clients that have the potential for introducing greater levels of complexity into their businesses. The account director provides data supporting the notion of complex business models:

“The underlying nature of the client’s business is extremely complex. For example, a power station transformer called a ‘peaker’ blew up. It took us fifteen months just to prepare the claim. The calculation method and the extent of data to calculate the downstream loss of margin resulting from this event required a forensic accountant to work out. This is not an off-the-shelf insurance product. The client operates in a very complicated market. The business model allows the client to generate electricity, consume or buy-back the electricity, and then re-sell it as a retail commodity”.

[Complex business models]

Relatedly, comments from the specialised broker indicate that small and seemingly innocuous changes to a business operation can have far-reaching, downstream implications: “...a simple water blasting operation, which seems pretty harmless, is contracted to work on airline runways. As soon as you apply this factor (aircraft) into the mix, it gets very tricky” [Contingent complexity].

Both the scale and size of a client’s operation and / or the diversity of what the client does act as further sources of external complexity. Larger corporate entities often have a wide, pan-geographic spread of assets and certain clients might identify as highly

diversified conglomerates, where they operate in several unrelated industries. As the commercial retail broker observes:

“Client A is complex because it is such a diversified business. They deal in many different sectors or industries but we handle their risks in one, single programme. They are really dynamic and changing and are highly acquisitive. Other clients, by comparison, work in one industry and they do not deviate from this – they are standard and pretty straight-forward”.

[Business diversity]

Similarly, the corporate broking role also views business diversification as a singular source of complexity:

“Client B has a wide range of mixed business interests in a single, large location. You start with how much risk the client is prepared to take themselves. There are internal risk transfer issues with the various different businesses the client runs. The complexities are tied to the variations in an underlying client business. That’s what makes it fun and interesting”.

[Business diversity]

The specialist broking role provides another example where diverse business operations exist as a source of complexity to the insurance intermediary: “Complex clients are often those that operate a broad range of services – where the client is involved in multiple or risky industries” [Business diversity].

Certain interview data reveal the underlying attitude of a client is an influential factor in the client–intermediary relationship. I refer to this relationship within my analysis as *client amenability* - a characteristic that indicates the willingness of clients to work alongside their intermediated service providers. The account director describes a solid, positive working relationship with his main client and the effect this has on the level of service provided: “That’s the bit I enjoy. A large New Zealand client is rare in the international scheme of things. They are insurance-and-risk-savvy. There is a lot of co-ordination and strategy involved with the engagement with the client” [Client amenability]. The account director indicates that a strong level of rapport exists between himself and the client, which is presumed to occur due to a mutual understanding,

respect and a willingness to work together. The national accounts manager and the specialist broker, respectively, emphasise this point further: “Some clients will work with you; others are more demanding” [Client amenability] and “Certain clients are just demanding or they make life difficult by not responding” [Client amenability].

Thus, client-facing knowledge worker roles face a range of external, objective complexity factors that emanate from several sources and, on occasion, may even stem from personality-related issues, such as overly demanding or unresponsive clients.

A notable exception to these common sources of complexity comes from the accounting role. In this case, complexity is perceived to occur internally, within particular processes or tasks related to data retrieval and dissemination. Reflecting on aspects of his role that are deemed to be complex or difficult, the accountant observes:

“Dealing with systems and extracting information. We have to find information based on a lot of raw data. Our (transactional system) is a broking system and not an accounting system. The lack of access, knowledge and familiarity with the system can make the job more difficult”.

[Cumbersome systems]

These data indicate that certain complexities are the resultant effects or by-products of both cumbersome systems and data volumes. Using unfamiliar or difficult systems creates user uncertainty, in terms of where to navigate to get an answer and, once found, whether the answer provided is actually correct. Exposure to progressively greater amounts of raw data adds further complication to this user experience. Relatedly, my analysis also reveals a similar notion where greater levels of external complexities result in proportionately greater levels of information needed to assess the insurance risk. This observation was coded as *information loads*, which the re-insurance broker evidences as follows: “...Power companies and mining are complex based on what they do – underground activities always carry a higher perception of risk and lots of underwriting information is required to get these risks placed” [Information loads]. The same participant goes on: “We deal in large volumes of information. A single underwriting submission may have 10 or 20 documents in it and we may have to send this correspondence to 15 re-insurers” [Information loads].

5.3.2 Sub-theme: Complexity treatment

The data provided by several participants point to a level of intuition which is required in their role. As the corporate broker observes, this attribute is tied to experience and is a skill which is honed over a period of time: “It all comes down to experience. You get a natural feel for what feels about right” [Intuition]. A similar sentiment is echoed by the accountant who notes: “You are trying to find or uncover what is already there, by looking through a lot of raw data. There’s an intuition about certain things where you ask ‘Why is this not working and where should I look’. It’s like putting the pieces of a puzzle together” [Intuition].

The most prominent concepts that participants refer to when discussing how they address complexities within their roles are relationships and experience. Despite being presented as separate terms, both experience and relationships are often used conjointly and expressed together in several responses. For example, given that a large part of knowledge work relies on personal judgement, each participant was asked how they know a satisfactory outcome had been achieved for a given client. In response to this line of questioning, the national accounts manager replies: “Market knowledge. Discussing the issue within the team. Past experience” [Background knowledge]. The account director frames his response in the following way: “Experience... A dialogue with the client will allow these things to emerge. I then have to translate these needs into a proper strategy aimed at addressing those needs.... Talking and relationships are vital” [Background knowledge]. Several participants provide data-rich details on the inter-personal mechanisms often associated with insurance transactions. The re-insurance broker emphasises experience and the presence of established, trusted relationships when interacting with insurance markets:

“Experience in the market is essential. Business also seems to follow underwriting personalities too. When someone shifts from one firm to another, often the business will follow that underwriter as they understand the nature of the underlying client’s business. These movements in personnel can create variations or changes in market conditions. It’s all about relationships – it’s a networking industry”.

[Established trusted networks]

The account director also discusses the same concepts, reflecting on the make-up and changes to his professional network following the catastrophic effects of the Canterbury earthquake, which occurred on 22 February 2011:

“My background is a placing property broker in the London insurance market. The Canterbury earthquake really impacted every piece of property insurance. The existing arrangement with carriers (insurance companies) involved in a client insurance programme is really important. They have history. They know and understand the client and have that existing relationship. They have spent time settling on a suitable contractual arrangement with the client. After the earthquake, they were not able to offer the same conditions or write the same levels of cover”.

[Established trusted networks]

These data paint a very social picture of the insurance industry. Insurance is a business built on relationships and predicated on entrenched and implicit trust. The presence of a trusted relationship commences within the principle of good faith established in all insurance contracts; it occurs in the engagement and confidence shared between the client and their insurance advisor; it occurs in the rapport and mutual support garnered between an intermediary and an insurance underwriter. The narrative around the business of insurance appears to be a fundamentally human one.

The data suggest that several apparent consequences occur when knowledge workers are confronted with increasing levels of complexity. Firstly, greater levels of complexity tend to generate more extensive, inter-departmental collaboration, which is acknowledged by the corporate broker: “There is a lot of bouncing between colleagues to help validate terms, risk, thinking. Information is shared regularly, usually by chatting about changing markets. We sometimes discuss these when we have quarterly meetings about key issues. It is pretty informal” [Informal collaboration]. Relatedly, comments from more transactionally-focussed roles echo the apparent association between collaboration and complexity, as evidenced by the comments made by the specialist broker: “We also discuss and share information amongst the team. When someone comes over to ask a question, there will often be four or five of us chipping in to the topic of discussion” [Informal collaboration].

The final outcome related to the treatment of knowledge work complexity pertains to the professional challenge of tackling such complexity factors and the resultant personal enjoyment and satisfaction that occurs. In this regard, the corporate broker states: “The complexities are tied to the variations in an underlying client business. That’s what makes it fun and interesting” [Enjoyment in the professional challenge].

To summarise, the data indicate that knowledge work complexities experienced by client-facing roles in the participating organisation often occur externally and relate to the underlying operations of a client business. The evidence also suggests that the strength of the relationship between the intermediary and the client may also influence perceptions of complexity. Knowledge workers resolve complexities through internalised, social methods, usually by relying on their past experience and established relationships. Furthermore, an apparent effect of increased knowledge work complexity results in a commensurate increase in informal collaboration, increased informational requirements and higher levels of co-ordination in order to execute particular tasks.

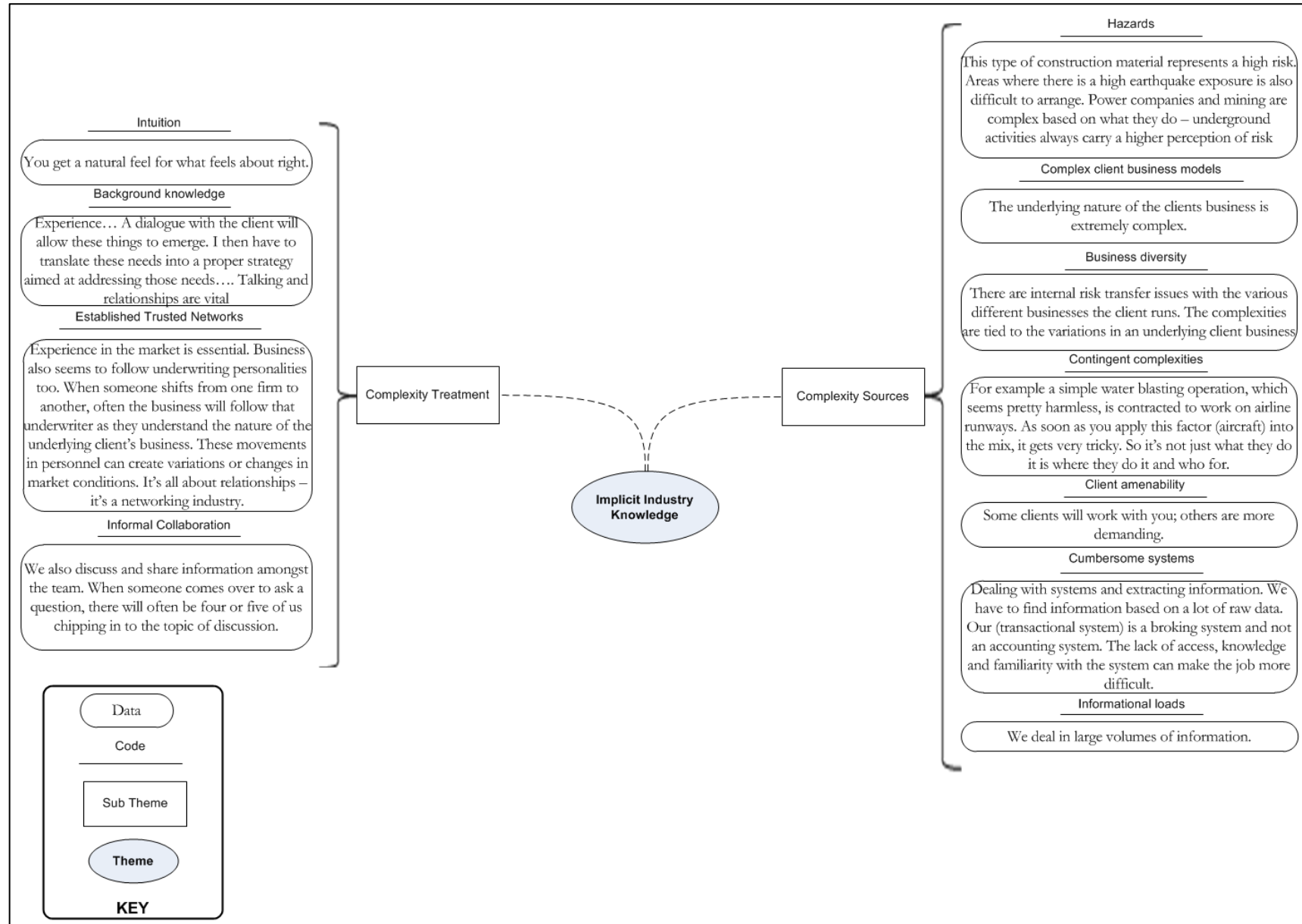


Figure 5-2: Thematic Map Two – Implicit Industry Knowledge

5.4 Theme Three - Context sensitive technology

The third theme drawn from the analysis is context sensitive technology. This theme suggests that technological requirements appear to shift in line with underlying client and end-user needs. That is, complexity factors appear to drive a demand for alternative degrees of technological functionality. Context sensitive technology is comprised of three sub-themes: system requirements, system constraints and divergent user experiences. The sub-theme of system requirements highlights a set of ideal system attributes required to meet the various tasks encountered by knowledge worker roles. Here, the notion of technological personalisation comes into sharp focus and highlights the need for systems to optimally reflect or represent the informational needs of various knowledge work roles. The interview data point to a requirement for end-user flexibility to fashion a desired output format as well as the need for more graphical user experiences as informational complexity progressively increases.

Where system requirements provide a hypothetical wish-list of technology, the second sub-theme of system constraints is based on actual user experiences of technology and highlights the various technological impediments encountered by participants during the performance of their roles.

The third sub-theme of divergent user experiences highlights the differences between certain roles in terms of individual user opinions of technologies and systems. In terms of overall technological perception, roles that use singular technologies for numeric calculation and financial information seem to fare far better than those who use a diverse array of technologies for written and verbal communication. A generally poor perception of technologies prevails amongst those end-users who require integrated communication tools to perform client-facing duties. Table 5-3 presents the development of the context sensitive technology theme, including its constituent sub-themes and codes.

Table 5-3: Development of Context Sensitive Technology Theme

Codes	Sub-themes	Theme
Personalised outputs; Graphical presentation; Optimal device for the job;	System Requirements	Context Sensitive Technology
Non-integrated systems; Inefficient processes; Poor utilisation; System inflexibility; Inadequate design;	System Constraints	
Word-processing applications; Communication tools; Accounting applications; Imposed technology; Sophisticated technologies;	Divergent User Experiences	

5.4.1 Sub-theme: System requirements

This sub-theme groups together the technological characteristics required by participants to effectively perform core knowledge working tasks. An emergent concept within this sub-theme points to the need for technological personalisation. Personalisation reflects how technology may be variously altered to meet individual preferences or modified to satisfy particular information requirements. In terms of the interview data, the concept of personalisation draws on two related ideas: personalised informational outputs and the need for graphical data. The specialised broker discusses personalised informational outputs in the following way:

“...when we use templates, these are often inflexible. We need to be able to adjust and fit information on to a page or template, and make that document look right for the client. It needs to have a professional aesthetic. Templates can be quite restrictive. Individual preferences come in to play here – I try to space things out so the information is presented nicely on a page. But what looks good to me is not regarded as good by one of my team members. Individual preferences can play a large part in what we produce”.

[Personalised outputs]

The commercial retail broker also reiterates the need for flexible, personalisable systems to address unique business situations: “For example, take someone’s report writing style. It is quite personal. We often need to think deeply about a client’s business, highlighting exposures and dig deep into their risk profile” [Personalised outputs].

Several roles in the corporate/consulting space suggest that better presentations and greater use of graphics are beneficial system attributes. The re-insurance broker states: “We also spend time drawing up mind maps – something to help this process would be great” [Graphical presentation]. Relatedly, when pressed on what attributes an ideal system should contain, the account director touches on the need for graphical content: “A broking system that handles general, transactional business contained in a co-ordinated workflow. That will take a large chunk of workload off you - maybe with some decent graphics to present back to the client. Market diagrams and placement structure graphical tools would be good” [Graphical presentation].

By way of a potential contextual explanation, this preference for more graphical client-facing content within these specific roles may be due to the relatively larger volumes of data and information associated with more consultative duties. The national accounts manager imagines interacting easily with the large datasets associated with corporate client servicing, and uses a visual, futuristic reference to articulate this: “I’d make them (technologies) intuitive, clever and a pleasure to use. I like the idea of interacting with graphics or objects that represent large bits of information – much like those futuristic movies! Right now, we have a very poor user experience” [Graphical presentation]. This call for graphical representation indicates a technological influence that needs to be sensitive to both end user needs and client requirements. Currently, end users interact with information using interfaces that commonly present data in singular, discrete fields or, alternatively, the data are aggregated into tabular format. However, data associated with larger clients indicate a need for a more intuitive, interactive and graphical representation of information, occurring as a function of larger and more complex data sets.

The interview data indicate that the physical medium used to represent information plays a part in user perceptions of technology. In a relatively recent initiative within the participating firm, all single display screens were replaced with dual monitors. Several participants, including the re-insurance broker, commented favourably about this particular capability: “The use of two screens has been great in this regard. It’s made checking stuff a lot easier” [Optimal device for the job]. Similarly, several participants suggested that using tablet or other mobile devices may have beneficial effects in their client-facing interactions. Reflecting on his preferred set of technologies, the account

director remarks: “Maybe presenting these things on smart devices or tablets, although I do not think that a bunch of apps would work for me. It might work for others”. [Optimal device for the job]

5.4.2 Sub-theme: System constraints

The sub-theme of system constraints groups data that relates to the processing and technological impediments that are currently perceived by participants when performing their role.

The views from all participants provide a frank and largely critical assessment of the subject firms’ current technological landscape, using terms such as “clunky”, “behind the 8 ball”, “irrelevant”, “disparate” and “non-integrated”. A robust summation of the ad hoc nature of the technological landscape is provided in the following remark by the national accounts manager: “There are so many piecemeal things. A bunch of non-integrated systems is a big thing with us. We have too many systems that do not help” [Non-Integrated Systems]. The idea of system disconnectedness also comes through in certain remarks made by the re-insurance broking role: “We often have to switch between two to three different systems just to find things” [Non-Integrated Systems].

An outcome of this divergent, disconnected technological environment is a high level of inefficient process, succinctly expressed by the specialised broker: “We re-key everything” [Inefficient processes]. Furthermore, as the account director observes, the presence of a disconnected technological landscape is further undermined by poor utilisation. “The technology itself is clunky. We do not use what we have very well. We should make better use of what we’ve got” [Poor utilisation].

Additionally, the notion of system inflexibility is identified by participants. System inflexibility manifests itself as a system constraint, which results in additional effort to achieve a desired result. The specialist broker observes the presence of inflexibility as follows:

“...when we use templates, these are often inflexible. We need to be able to adjust and fit information on to a page or template, and make that document look

right for the client. It needs to have a professional aesthetic. Templates can be quite restrictive”.

[System inflexibility]

The accountant also indicates the idea of systemic inflexibility in terms of an awkward design feature: “In our banking system, its interface allows you to set up multiple payer accounts, but even if you only have one payer account the data is still presented to you in a drop-down box which you need to select” [System inflexibility].

Looking more deeply into these critical views, there appears to be a distinction between roles about where these perceived systemic deficiencies occur. For example, the accounting role focusses on user experience issues, how information is presented and positioned on screen – in other words, technological issues and impediments are generally aimed at superficial or surface level technological complaints: “(The technologies) lack an intuitive design or an easy-to-use interface” [Inadequate design]. In contrast, the comments from client-facing roles indicate that systemic deficiencies occur in deeper representations of the technologies used. For example, the re-insurance broker states: “(the technology) does not allow for individual variation of particular transactions and does not entirely reflect the entire processing flows of a re-insurance transaction...” [Inadequate design]. Thus, the nature of technological challenges confronting client-facing roles appears deeper and more functional than those of supporting roles. Furthermore, the technologies identified in these criticisms extend past the stable of mission-critical technologies used in the subject firm. Peripheral applications, such as the Human Resources (HR) system are also called into question by the national accounts manager: “The HR system – we’ve made it easy for management information but it’s a shocker to actually use” [Inadequate design].

5.4.3 Sub-theme: Divergent user experiences

The predominant technologies used within the research context are word processing applications, accounting-based packages and various communication tools which include electronic mail, and mobile or landline telephones. The data indicate that all client-facing roles require a variety of communication tools – both verbal and, in particular, text-based applications - to perform relevant tasks. First and foremost, and as stated by the specialist broker, there is a known need for written formality and

procedure within the insurance industry: “....everything we do needs to be evidenced in writing” [Word-processing applications].

Both the corporate broker and national accounts manager respectively indicate a preference for communication tools to execute their day-to-day tasks: “Phone and mail for communication. Word and Excel for report writing” [Communication tools] and “e-mail for all forms of written communication, however my preference is to use the phone to make contact. I use Excel for placement programs and premium calculations” [Communication tools].

Additionally, there is evidence of a more informal, internal level of communication within client-facing roles, which usually occurs within a team or group. No system is used for these interactions due to their often spontaneous and informal nature. These interactions are variously described as “chats” and “pretty informal”, where issues are discussed and shared within the team - allowing people to “chip in” to the topic of discussion.

In contrast to the technologies used by client-facing roles, the accounting role uses a single general ledger package for the majority of accounting tasks, with some reporting and inquiry tasks performed in one or two other systems. The data excerpt below, provided by the accounting role, details the software applications commonly used to perform his tasks:

“General Ledger software – which is an accounting package and spreadsheet interface. The broking system. Certain finance reports on the corporate intranet. A little bit of Excel, but not as much as you might think. We do not usually need to use many of the sophisticated features associated with Excel such as Pivot tables and VLOOKUP. We get the information provided without the need for these functions”.

[Accounting applications]

Accounting, finance and taxation tasks are also common in the captive consulting role and the captive management consultant highlights her use of a singular application for both numeric and text-based content:

“Excel is used because numbers are predominant in the work performed. Mail is used for communication. Excel is also used for more discursive content, as opposed to Word. I find it is easier for formatting and aligning numbers and text. It also allows a document to be worked on in a single application without having to jump out of a spreadsheet and import a table into Word”.

[Accounting applications]

During my analysis of the data related to technological usage, an apparent difference emerged between the technological tools used by various roles. Those roles that work mainly with numbers are able to work in one or two central, connected applications; roles which are based on verbal or written forms of communication use several, disconnected technologies to perform their tasks.

Another inter-role difference that emerges from the data involves the notion of imposed technology. This particular constraint relates to systems that have been forced upon certain client-facing roles through the political will of upper management within the participating organisation. The technology in question is a Decision Support System (DSS) - a so-called ‘market-matching tool’, which is used in overseas regions to help align a clients’ risk profile and insurance requirements to suitable, recommended insurance markets. Participants whose role is affected by this system provide particularly negative comments regarding its mandated use. For example, the corporate retail broker states:

“It is a poor fit in terms of local conditions. Our market is too small to justify a market-matching tool. It serves no other purpose other than additional information gathering and revenue generation from carriers (insurance companies). It is a real imposition. It asks clients to prioritise certain measures that do not make sense. How do you prioritise measures that have equal weight? It is not client-focussed at all”.

[Imposed technology]

The specialist broker reflects similar sentiments when discussing the enforced use of the DSS, stating that it “...is a waste of time. The New Zealand market is so small it does not serve a need here. It actually creates a need – it sucks my time! Also, it has been

forced on us by overseas management – which I understand – I get why it is there. But it is not helpful at all” [Imposed technology]. The national accounts manager provides a slightly more restrained but no less critical assessment on the use of an imposed technology:

“... (it) is relevant in some ways. Some of the data captured is useful and there is a revenue generation aspect to it. But it is not relevant to us in terms of market-matching. In New Zealand, we have seven insurer markets we have access to. We do not need technology to inform us about such a small market. It’s just another process and it’s never done in real time – always after the event which proves it is not used to support (its main purpose)”.

[Imposed technology]

Conspicuously, and in stark contrast to the overall views of the client-facing roles, a more positive overall view of technology is perceived by the accountant: “I think we are quite sophisticated. There’s always someone you can turn to and there is always someone trying to progress our systems to improve things” [Sophisticated technologies]. The inference drawn from these particular comments suggests that the accountant considers the systems he uses as sophisticated and this sophistication draws from the involvement of people charged with supporting and developing such systems. Similarly, within the interview data, the captive management consultant confirmed that the technologies she uses in the performance of her role were generally adequate for her needs. Several potential contextual explanations may account for these somewhat isolated views. Firstly, there is no imposed requirement on the accounting and finance roles to use the DSS. The mandated use of the DSS appears to generate a considerable level of ill-will amongst end-users of that system; accounting and finance roles are not required to use the DSS. Secondly, the accounting and finance roles utilise numerically-based technologies that are designed specifically to address accounting tasks and duties; the business of numbers and accounting are natively built into accounting packages and Excel spreadsheets. Conversely, no equivalent system specification exists within the technologies used by client-facing roles – the various processes associated with insurance broking are not contained in e-mail or word processing applications.

In summary, the theme of context sensitive technology indicates that knowledge workers within the participating organisation require systems that can meld to meet the needs of the various clients they represent. Ideally, interactions between knowledge workers and their systems would reflect high levels of flexibility, enabling business information to be shaped and presented based on varied task requirements, individual user preferences and optimal output formats. Overall, the interview data paint a rather bleak picture of the participating firm's current technological landscape, especially as it relates to client-facing roles. The systems used within the participating firm present as a disconnected, inefficient array of poorly aligned solutions, which, in certain cases are forced upon particular roles. The nature of knowledge working roles appears to cause a divergence of technological perspectives. Roles that focus on numeric calculation and financial reporting are capable of being contained in mainly singular systems, whereas roles that employ written and verbal communication use a variety of non-integrated tools, including the enforced use of a mismatched DSS, to execute their duties. These divergent contexts result in split views related to technological satisfaction and use; client-facing roles exhibit a high level of end-user cynicism whereas accounting-based roles offer a less jaded opinion about technology.

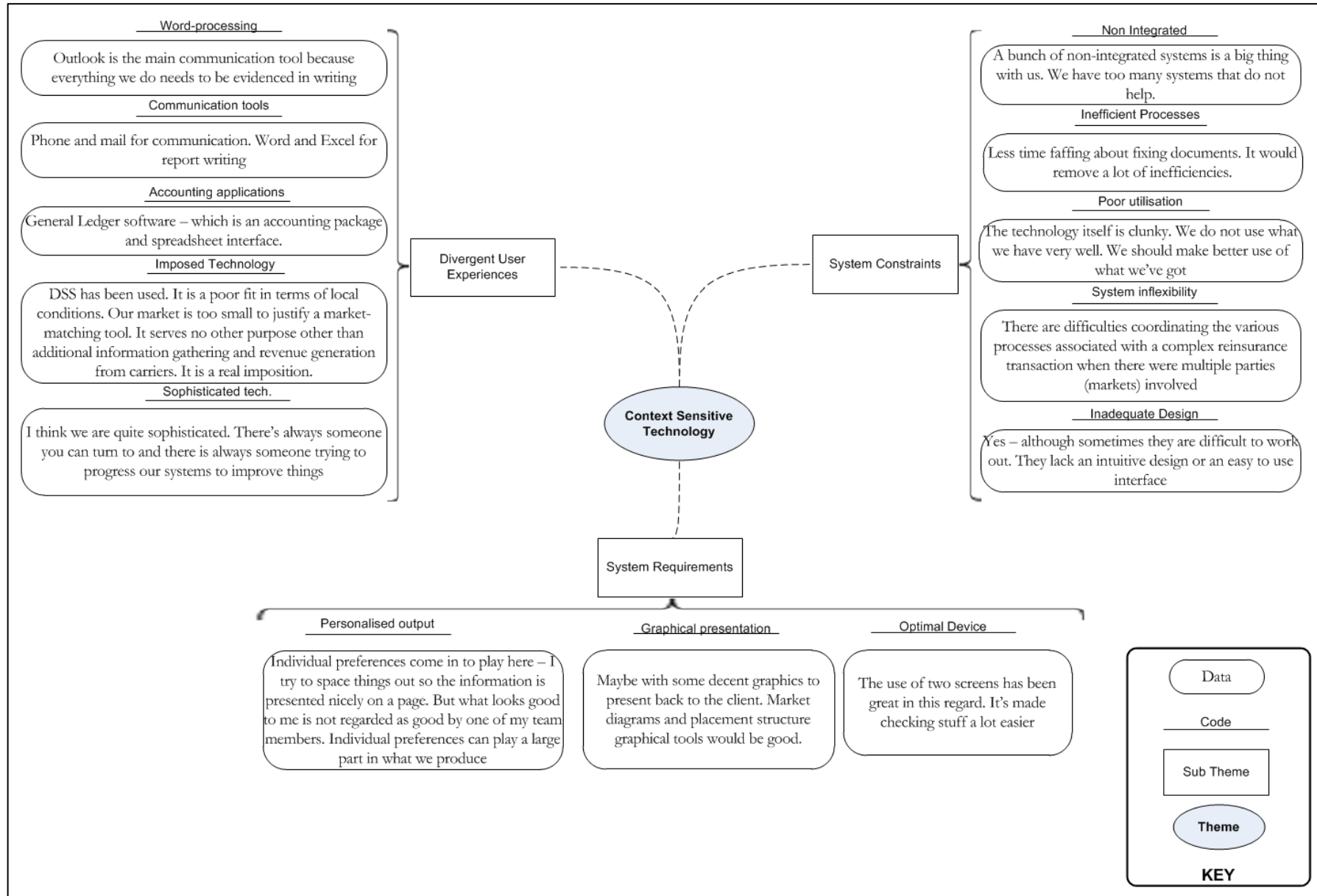


Figure 5-3: Thematic Map Three – Context Sensitive Technology

5.5 Theme Four – Mixed organisational support

The theme of mixed organisational support highlights a dichotomous workplace environment, which acknowledges a generally positive view of local ICT support and regional management tempered against a perception of a disconnected overseas management. The imposition of particular administrative processes tarnishes the views of certain participants, and highlights the complications that arise when working within a formal, traditional organisational structure. Two sub-themes are presented in the theme of mixed organisational support, namely local managerial engagement and managerial indifference from overseas. Local managerial engagement provides a positive commentary of local organisational structures, reporting lines and general support whereas managerial indifference from overseas presents a contrasting view of international management practices that negatively impact upon the work lives of various participants. Table 5-4 presents the development of the mixed organisational support theme, including its constituent sub-themes and codes.

Table 5-4: Development of Mixed Organisational Support Theme

Codes	Sub-themes	Theme
Engaged local support; Quality networks;	Local managerial engagement	Mixed Organisational Support
Under-resourced; Unsympathetic; Inadequate training; Administrative overhead; Role recognition;	Managerial indifference from overseas	

5.5.1 Sub-theme: Local managerial engagement

The majority of interview participants feel they receive good support from local management and support networks. As the accountant states: “I’ve been very lucky with the level of technical support and resource I get. They are excellent” [Engaged local support]. The corporate broking role reinforces the support received at a local level: “Locally, we have support for what we’ve got, in terms of local administration – they help out well when we need them” [Engaged local support].

The one exception to this general sentiment comes from the account director who expresses a certain feeling of isolation, which, when looking at the context of the role, may relate to the sole charge of a large client. In spite of feeling a certain level of

disengagement, the account director mentions his off-shore support network; those colleagues he relies upon to help service his client's international insurance programme:

“It’s just me. The entire responsibility of the account rests with me. I get a hard time about looking after only one customer. I feel quite isolated and unsupported. However, the quality of the international resources and network is very high and reliable. I lean on them a lot”.

[Quality networks]

5.5.2 Sub-theme: Managerial indifference from overseas

Where local management and ICT support are widely lauded for supporting the business interests, comments relating to international, upper management as well as various support services delivered from overseas are markedly less favourable. The specialist broker frames the discontent in terms of poor resourcing:

“The international management do not support us and we see this by low staffing levels. We are simply expected to work more with less. They will dangle the carrot ‘if you make us more money, we will get you more staff’, but as we try to earn more we create more cost and this is held against us”.

[Under-resourced]

A similar sentiment is echoed by the corporate broker: “We are not given the technologies we need due to cost constraints and a lack of understanding” [Unsympathetic]. The same participant goes on to express the issue more generally, as a function of an indifferent and unconcerned management layer:

“There is a huge disconnect between the broking teams and management. It is management by analysts and accountants who have no idea about what we do. They are only concerned about share price and their bonuses. And they are temporary. They will only last three years before they move on”.

[Unsympathetic]

Additionally, specific mention was made about the lack of training provided – which may also allude to managerial oversight, general indifference to staff needs or a greater

priority placed on cost reduction. The specialised broker states: “A proper Word training session would be useful. We do not use it well. We know just enough to get by” [Inadequate training]. The national accounts manager repeats this notion and indicates a desire for training in the application he uses most often: “(I use) Outlook mainly – although I am a bit of a novice. Some training to use it properly would be useful. Excel is the next most common application I use” [Inadequate training].

Most participants indicate that their role has been subject to some form of procedural change over the last year. Several client-facing roles note the increase in administrative duties and compliance overhead they are required to perform, with resultant feelings of work dissatisfaction. The national accounts manager frames the administrative requirements in the following way:

“We are hugely bogged down in internal stuff. For example, the compliance overhead. I have to deal with three layers of audit. I have an allocated number of files I have to review monthly for the business unit I look after. Then there is a local compliance audit – twice per year. Then there is the international audit which occurs annually”.

[Administrative overhead]

The frustration evident in these comments is also reflected by the captive management consultant, who says: “A lot of time is spent on things that do not add value. You waste so much time on stupid, clerical, administrative things that do not matter [Administrative overhead]. The inference taken from these comments is that perceived increases to administrative overhead impede more valuable activities within client-facing roles.

Participants generally feel that a broad understanding of their role is either important or vital for ongoing business operations and devising technical solutions. As the corporate broker observes: “If you don’t understand what I do, you’ll never understand what I need – technology-wise, knowledge-wise – to do my job” [Role recognition]. In spite of the importance placed on role recognition, several participants feel their role is poorly understood. The captive management consultant states: “No-one really understands the ‘ins-and-outs’ of what we do” [Role recognition]. The prevailing context that seems to

explain this condition relates to the level of regular interaction that occurs between roles and business units, as the re-insurance broker observes: “Some people get what I do – most do not. Senior colleagues know what I do because I work alongside them. It’s who you interact with. Most retail brokers have no need to know what I do” [Role recognition].

Thus, a mixed organisational appraisal emerges from the data. A level of disenchantment is apparent amongst certain client-facing roles with respect to the level of administrative overhead encountered, whereas other roles have seen procedural improvements. Additionally, the interview data indicate the existence of a supportive local management and competent ICT support functions, pitted against a general perception of a disconnected, indifferent international management structure that acts as a financial and technological constraint to business operations. Figure 5-4 provides a graphical representation of the data excerpts, codes and sub-themes that make up the mixed organisational support theme.

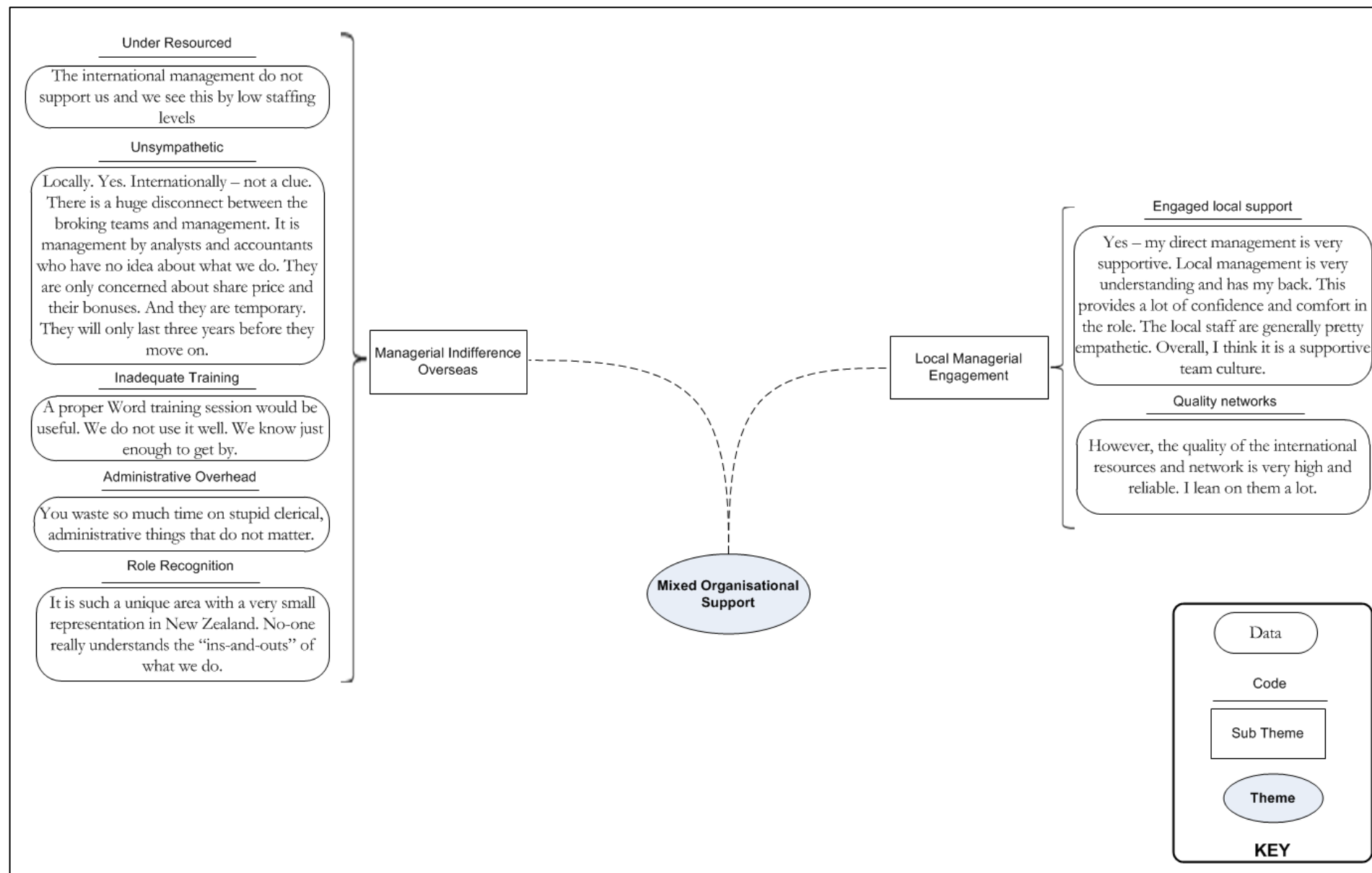


Figure 5-4: Thematic Map Four – Mixed Organisational Support

5.6 Summary of findings

My findings suggest that the business of insurance intermediation displays somewhat contradictory characteristics; a series of relatively prescriptive, time-sensitive and predictable processes related to the legal arrangement of insurance contracts exists in contrast to various underlying, exogenous and relatively unpredictable complexity factors related to client businesses that the participating organisation represents. Examples of these complexity factors include, but are not limited to, the size or scale of the client's business operations, variations in the client's business model, the location of the enterprise and the nature or occupation of the business operations. These complexities often present as unpredictable, emergent factors, which must be translated into suitably crafted, insurance or risk-management solutions, based on the expertise of the knowledge worker. Relatedly, the emergent and combinatorial nature of these complexity factors can create unpredictable and multi-final outcomes.

The presence and nature of these complexity factors seem to mediate the task characteristics associated with the work performed by knowledge worker roles. That is, certain knowledge work tasks performed in the research context are difficult to typify or standardise as the underlying complexity factors often alter the task composition needed to provide suitable risk management and insurance solutions. The fluid nature of such work gives rise to the theme of mediated knowledge work.

The second theme that emerged from the findings was implicit industry knowledge, which indicates that the methods used to treat knowledge work tasks are contained in the minds and experience of individual knowledge workers. At issue here is whether or not tasks associated with the theme of implicit industry knowledge are analysable and thus capable of being codified and captured in a system.

The theme of context sensitive technology further elaborates on the influence of complexity and its imposition on technological requirements, where different technical attributes are needed to meet progressively more complex task requirements. In particular, the attributes of flexibility, adequate data representation, and an integrated user experience all figure prominently as desirable technological features in the analytic findings.

The fourth theme uncovered by the findings was mixed organisational support, which points to a level of conflicted leadership within the participating firm. At a local level, participants feel that they receive high levels of managerial and technical support; at an international level, the consensus indicates the presence of a disconnected and indifferent managerial layer. The theme of mixed organisational support suggests that fit or misfit occurs due to the presence of particular organisational conditions.

I proceed to discuss the merits of these four themes in terms of their theoretical relevance and their relationship to technological fit causality in the next chapter.

Chapter 6 Discussion

6.1 Chapter outline

Up to this point, this study has provided an evaluation and analysis of fit as it relates to Task-Technology Fit (TTF) theory. The findings chapter detailed the analytical results, which yielded four themes of possible underlying fit causality: mediated knowledge work, implicit industry knowledge, context sensitive technology and mixed organisational support. These themes, which were derived from data collected from a series of semi-structured, workplace interviews, may singularly or collectively point to the underlying causes of fit.

To address the central objective of this research, this chapter brings together these various analytic components. As such, analysis gives way to synthesis, which requires a holistic interpretation of the findings. To achieve this, I review and summarise the four themes gathered from the data analysis and accentuate my findings as they relate to the causal conditions of technological fit. Particular points of discussion are then assessed against the literature, to check for theoretical support and veracity. This process requires a reiteration of the main topics covered in the literature review chapter as well as applying additional literature relevant to the theory or theme being discussed to deepen my arguments. To conclude the research, all four themes are subjected to retroductive analysis - a common analytic method used in critical realist research which was outlined in the Methodology chapter. To recap, retroduction provides a means for a researcher to determine causality based on the strength of the most plausible explanation.

6.2 The presence of complexity in knowledge work

Before delving into a series of specific theoretical discussions on the uncovered themes, it is necessary to first stand back and cast a wide view over my findings. With the exception of mixed organisational support, all themes make some reference to a common denominator: business complexity. Complexity factors appear to act as causal mechanisms within knowledge work environments and influence the nature of tasks, how those tasks are approached by individuals, and the features embedded in technologies that are built to process those tasks. To reconcile the presence of

complexity and establish its relevance to my findings, I reference and discuss aspects of complexity systems theory and critical realism.

The Latin origins of the term – ‘complexus’ - refers to an object woven together as a composite, the whole of which is more than the sum of its parts. This image of an interwoven object incorporates two notions germane to technological discussions: interconnectedness, which deals with the number of connections or relationships contained in a system, and intricacy, which is suggestive of the amount of information or detail contained in those connections (Moses, 2010). Another common concept in complexity systems theory is that of emergent behaviour (Sussman, 2000). Emergence is a phenomenon or process where a composite, whole object demonstrates certain properties, patterns or behaviours not evident within its constituent parts. Take, for example, water. It can present in solid, liquid or gaseous forms (depending on ambient conditions) but its constituent elements, hydrogen and oxygen do not individually possess these properties. Relatedly, a core principle in critical realist thinking is the notion of contingent causality (Sayer, 1992), where causal structures and mechanisms are said to exhibit a “trans-factual” nature. Trans-factuality relates to the production of non-linear outcomes, such that a generative mechanism may produce multi-final or equi-final outcomes or, of course, no outcome at all. Multi-finality pertains to divergent outcomes occurring from seemingly similar inputs; equi-finality is where the same outcome occurs from varying inputs.

As such, the established complexity theory resonates with my findings in two key areas. Firstly, the varied requirements of particular knowledge work align to the notion of interconnectedness and informational intricacy as presented by Moses (2010). Secondly, emergent and underlying complexities, such as a client’s operational scale, location and/or type of industry present as transfactual or combinatorial complexity factors, which affect task structure (Gill & Hicks, 2006) and are thus capable of creating multi-final outcomes (Sterman, 2000; Sayer, 1992).

A critical realist ontology provides a useful framework within which to present these complexity factors. Critical realism presents these underlying business complexities as unseen, real entities, which have emergent, causal properties. These business complexities variously combine and manifest themselves as events, occurring in the so-

called actual domain, in the form of varied, unpredictable tasks. These emergent tasks are then presented in the empirical domain as observable, actionable items of work, executed by a mix of human and technological agents. Figure 6-1 depicts these ideas using a critical realist mental model, demonstrating the dynamic and inter-related association that each component shares as well as where each component is positioned in the real, actual and empirical ontological domains.

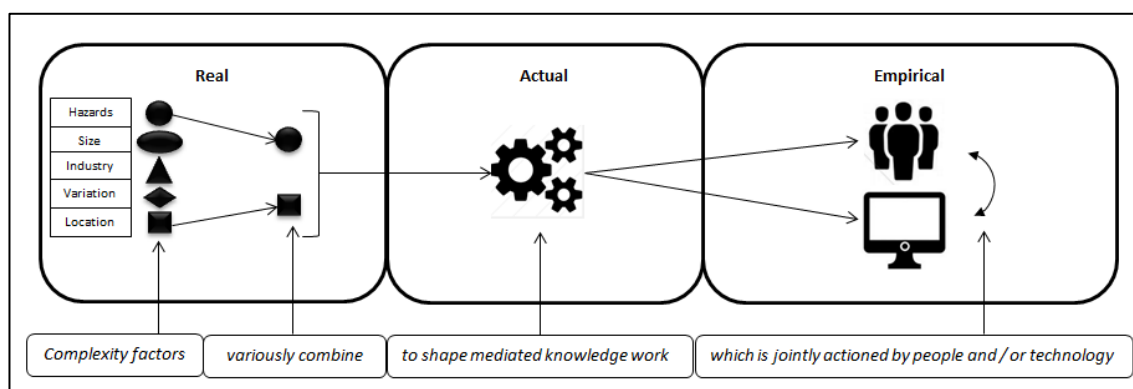


Figure 6-1: Critical realist model of complexity factors, mediated tasks and actionable outcomes.

I continue with a theoretical explanation for each of my thematic findings in the following sections.

6.3 A theoretical review of mediated knowledge work

The essence of mediated knowledge work suggests that contingent complexity factors variously combine to influence the nature of a given knowledge work task, and thereby create varied or graduated knowledge work. Given that knowledge work task requirements are capable of wide variation due to their exposure to the underlying complexities tied to a client's business, it follows that the technologies used to process such tasks must also be capable of reflecting these changeable task characteristics. To help theorise this causal theme further, the literature related to knowledge work and task theory is re-examined and discussed in greater detail.

Within the literature review chapter, I highlighted a notion proposed by several theorists (Dahooie, Afrazeh & Hosseini, 2011; Kelloway & Barling, 2000; Ramirez & Steudel, 2008), in which knowledge work can be conceptualised as an occurrence along a virtual continuum. The degree of knowledge work involved in a job or role can be variously

positioned on this continuum, ranging from more manual, physical activities at the lower end of the continuum, to more intellectual activities at the higher end, made manifest by increased levels of creativity, expertise, unpredictability and innovation. The findings and the resultant theme of mediated knowledge work tie into this theoretical representation well. Certain tasks performed in the research context are well-defined and exhibit significant levels of structure and predictability. Using a dynamic knowledge work model, such tasks translate into lower level knowledge work dimensions. Equally, the findings indicate that a certain amount of creativity and innovation is experienced in several roles. More significantly, the nature of the work can shift suddenly and unpredictably within any given knowledge worker's role from structured to unstructured knowledge work. These shifts occur as a result of certain underlying, contingent changes to a client's business, and have the effect of moving potentially lower order knowledge work levels to higher order knowledge work levels. Of interest, where certain theorists propose a firm or role-level perspective to their knowledge work continuum (Ramirez & Steudel, 2008), my findings suggest that finer units of analysis, such as tasks and knowledge work activities may also be validly applied to the knowledge work continuum.

The use of McGrath's (1984) task types, summarised in Table 2-1, helps to better illustrate the changeable task dynamic within the theme of mediated knowledge work. The data gleaned from the findings indicate an element of work predictability is present in all roles, which aligns with the tasks models' Type 1 – Planning tasks. Most roles in the participating firm demonstrate high levels of Type 3 – Intellectual and Type 4 – Decision-making tasks. Several roles that align with transactional-service offerings indicate low levels of Type 2 – Creativity tasks, whereas roles that align with bespoke solutions indicate higher levels of Type 2 – Creativity tasks. I posit that the composition of a given knowledge work task alters based on presence of various complexity factors, and the actual changes to task composition occur in two ways: alteration based on task type combinations and the alteration of the relative strength of certain task types.

Aspects of my analysis suggest there is a certain sameness shared between client-facing roles when participants describe what they actually do. The findings indicate that all participants interact with clients and carrier markets in relatively similar ways; all client-facing roles in the study obtain pre-renewal risk data to help guide and inform

suitable solutions for clients; all generate particular legal documentation at certain points in time to evidence legally enforceable contractual arrangements for their clients. The source of inter-role task variance originates in the various complexity factors associated within the clients business and risk profile. These complexity factors dictate how a task is addressed and influence whether a task is performed singularly or within a group. Crucially, my findings suggest that the introduction of progressively more complexity into a knowledge work environment increases the prevalence of creativity, innovation and subjective judgement-making actions. These are intuitive task characteristics that are ‘felt’ and experienced by individual knowledge workers. Such tasks are embodied in so-called ‘soft’ skill sets, which are individually developed through professional experience over time. These less tangible task characteristics are difficult to convey in common, everyday language, which makes their interpretation and assimilation into the technical realm a particular challenge.

Before progressing further into this aspect of the discussion, I need to highlight where my views depart slightly from the accepted wisdom articulated by many task theorists. It is usual to find tasks described in the literature as individual versus group-based (Zigurs & Buckland, 1998; Gladstein, 1984) or simple versus complex (Campbell, 1988; Gill & Hicks, 2006). These dichotomous classifications infer task exclusivity, in that an individual task is always an individual task, separate and distinct from a collective or group-based task. As an example of an exclusive task type definition, we might say: ‘walking is a simple task compared to flying a helicopter, which is a complex task’. My view, based on the findings, suggests that the *same* task, performed in a knowledge work context, can either be simple or complex and individual or group-based, depending on the underlying conditions.

To help support my position, I use a hypothetical business scenario to expand this idea and I refer to elements of task complexity theory proffered by Gill and Hicks (2006). Part of an insurance intermediary’s role is to review and compare market responses from insurance companies (carriers), who are periodically engaged to compete for a particular client’s business. Insurance carriers negotiate contractual conditions and pricing by offering ‘terms’. More specifically, terms pertain to the various legal conditions, clauses and other content that inform the insurance policy, often varying per carrier. A comparison of terms requires the intermediary to interpret and weigh the

relative merits of each carrier response. Once their meanings are derived, the legal significance or implications of these terms then need to be applied and specifically related to the client's business. The intermediary will mentally work through 'what if' scenarios, the probability of certain events occurring that might invoke particular parts of the insurance policy and the cost versus benefit of certain insurance terms.

From a pure informational load perspective, the actual number of comparisons that confront the intermediary present as a complexity factor (Gill & Hicks, 2006). In other words, comparing the respective policy conditions from two separate carriers is relatively easier to mentally manage than a comparison between six or seven carriers. Additionally, there is a qualitative aspect to this exercise that must be allowed for. A comparison of two insurance clauses that cover the same topic is a relatively straightforward exercise. For example, the policy condition: 'upon the happening of event *x*, the policy will provide benefits *a*, *b* and *c*' is superior to the policy condition: 'upon the happening of event *x*, the policy will only provide benefit *a*'. Assuming that event *x* and benefit *a* are equivalent between both policies, the policyholder is better off with the first option as it provides greater coverage. But how does the intermediary determine the relative superiority of terms when direct comparisons cannot be made? How does the intermediary treat a range of both beneficial and detrimental policy terms? Should all insurance terms be considered equally? If not, which terms carry greater weight or importance? These factors impact upon the knowledge worker's "problem space" - the cognitive system employed by an individual to address a problem or to perform a task (Gill & Hicks, 2006). From a task composition point of view, the act of comparing insurance terms involves a mix of intellectual and decision-making activities (McGrath, 1984), but additional complexity factors increase the relative strength or intensity required to perform these tasks. Further, the number of items to work through may affect the time-management aspect of the task. An intensive review of numerous contractual conditions may require many hours of uninterrupted concentration; an event which might introduce a planning characteristic to the task mix (McGrath, 1984) that would not otherwise exist in cases where fewer items require comparison. Finally, if the terms are not totally understood or fall outside the intermediary's domain of expertise, greater complexity is encountered, challenging the individual's inexperience (Gill & Hicks, 2006), thereby forcing the intermediary to enlist experienced help to perform the task. As such, the task now morphs from a singular task type into a group-based one.

How does all this relate to the discussion about technological fit? If the nature and the dimensions of a task move around in potentially unpredictable ways, the ability to define business requirements and incorporate these into a suitable technological solution is made all the more difficult. The vacillations between lower order and higher order knowledge work tasks suggest that such tasks are comprised of mixed or dichotomous characteristics. The existence of a contractual expiry date within most insurance contracts lends itself to an orderly, sequential set of processes, each of which can be defined within a series of predictable, predetermined actions. The legal nature of the underlying insurance policy dictates that each process must be compliant and structured, with all outputs evidenced using precise, formalised legal language. These particular characteristics lend themselves well to standard processes; a capability which appeals to those charged with system design and development. Running counter to these definitive task characteristics are the unique client requirements that inform the content of single insurance policies and the design of whole insurance programmes. These are the task characteristics that are heavily emphasised throughout my findings. Each client business has its own unique risk profile, a specific commercial fingerprint, the interests of which cannot be fully protected unless the individuality of the business is sufficiently reflected in the insurance coverage. The development of bespoke insurance solutions on behalf of clients confronts, but occurs within, a framework which seeks to standardise and automate operational processes.

Compounding this arrangement is the organisational context within which this mediated knowledge work occurs. Gaining an understanding of knowledge work tasks, including the nuances of numerous insurance products and the underlying factors that cause tasks to vary is made all the more challenging in a large multi-national organisation. It is unlikely that a full understanding of international insurance practice exists in a single expert skill-set. This context requires system analysts, architects and designers to solicit a wide range of end user views and experiences, to avoid developing systems that may not recognise certain aspects of particular insurance transactions or that solely focus on the standard processes associated with the insurance policy renewal cycle. A technological solution that only advances the standard aspects of such knowledge work, without recognising the existence of task variation, risks introducing system

deficiencies; a so-called “fit as coverage” problem, to borrow from the work of Strong and Volkoff (2010).

In summary, the theme of mediated knowledge work indicates that knowledge work tasks alter in response to imposed complexity factors. As a theme, mediated knowledge work resonates with various aspects of the theoretical literature related to task theory (Campbell, 1988; Gladstein, 1984; McGrath, 1984) and knowledge work theory (Dahooie, Afrazeh & Hosseini, 2011; Kelloway & Barling, 2000; Ramirez & Steudel, 2008). In terms of its relation to the causation of technological fit, the presence of mediated knowledge work creates difficulty in establishing a complete understanding of task requirements and without a full and clear understanding of the task, any technological solution designed to meet that task is likely to be flawed.

6.4 A theoretical review of implicit industry knowledge

The theme of implicit industry knowledge indicates that significant business know-how is stored within the minds of individual knowledge workers. The prevalence of implicit industry knowledge is assumed to occur in proportion to progressively greater levels of complexity. The absence of a technological solution to address these underlying complexity factors forces the actor to address the task individually and internally, by falling back on their own experience and personal knowledge to provide an appropriate response or outcome.

Evidence of implicit industry knowledge occurs in two main areas of my findings: the widespread presence of individual judgement-making within many knowledge work tasks and the prevalence of personal experience and professional relationships, which are used by individual actors to interpret and address certain knowledge work tasks. As with the theme of mediated knowledge work, implicit industry knowledge is impacted by the presence of certain complexity factors. Where complexity alters the task composition of knowledge work, implicit industry knowledge acts as a mental ‘tool box’ that an individual can draw from to resolve such task variations. The extent of personal experience seems to be the central condition that underpins this particular theme. An experienced knowledge worker implies an individual with certain expertise, which is created over time through exposure to a wide array of professional issues. The findings indicate that experience helps develop comparatively deeper levels of

credibility and a wider sphere of influence throughout a network of peers. Greater experience improves the likelihood of understanding difficult business issues, knowing what works and what does not. As such, personal experience improves the problem space (Gill & Hicks, 2006) or cognitive processes (Vessey, 1991) used by the knowledge worker to treat complex tasks. I also contend that experience and deep reserves of professional knowledge lessen the need to collaborate – a spontaneous event uncovered in my findings where individuals seek to gain an understanding of a problem or business issue from a wider group of knowledge workers.

These findings need to be assessed against the established literature. According to Nonaka and Takeuchi (1995), knowledge can be categorised as either explicit or tacit, with the two forms existing at opposite ends of a conceptual knowledge spectrum (Leonard & Sensiper, 1998; Augier & Thanning Vendelø, 1999). Explicit knowledge is defined as knowledge which can be expressed easily and rationally, in words and numbers. It is socialised and sits external to the individual and, as such, it can be defined, structured and codified, thus lending itself to a form of digitisation. Tacit knowledge is defined as “knowledge-in-practice developed from direct experience and action; highly pragmatic and situation specific; subconsciously understood and applied; difficult to articulate; usually shared through interactive conversation and shared experience” (McAdam, Mason & McCrory, 2007, p. 46). There is a strong resemblance between the theoretical definition of tacit knowledge cited above and the many remarks made from interview participants related to the task complexity experienced in their role. The codes of intuition, creativity, informal collaboration, experience, and interpersonal relationships generated during the analysis all indicate a strong association to the theoretical description of tacit knowledge. The essential question to raise here is this: does the presence of tacit knowledge occur as a result of a technological absence or does tacit knowledge cause a technological absence?

I contend that technology is a representation of a known set of processes and explicated knowledge. The extent to which implicit or tacit knowledge is present in an organisation appears to correlate, in some way, to the lack of availability and use of suitable systems to perform related tasks. The codification or analysability of knowledge work tasks requires taking the internalised, silent, mental processes employed by individuals and turning them into well-defined, external procedures, rules and codes. Recalling the work

of Rice (1992), a task becomes analysable, and thus capable of codification, when pre-determined responses and outcomes can be developed to resolve a given problem or set of problems. My findings suggest that tasks related to certain roles may be capable of such codification, but those roles that are more consultative and bespoke in nature may be less capable of such analysability. The various judgement types uncovered in my findings provide an apt example here. Relative judgements, which pertain to objective, discrete and repeatable decisions, are quite capable of representation in a procedure; interpretive judgements, which weigh the meaning of words, are much less capable of codification. The alteration of a single word or the placement of certain punctuation within a sentence has the potential to significantly alter the meaning of a piece of text. Bearing in mind that textual content is the essence of a legal contract, the correct use and interpretation of such textual data is vital. A trained, human mind can perform these types of tasks extremely quickly. Conversely, the development of computer code to synthesise and interpret related, but contending, bespoke legal manuscripts, while, at the same time, applying the relative merits of each text against a set of possible client exposures represents an enormous technical hurdle. There is presently a very real possibility that certain types of knowledge are incapable of being adequately externalised into a technological solution.

6.5 A theoretical review of context sensitive technology

The theme of context sensitive technology indicates the need for different IS modalities in a knowledge work environment. As a theme, context sensitive technology acts as a logical antecedent to the themes of mediated knowledge work and implicit industry knowledge. As contingent complexities give rise to changeable knowledge work conditions, the varied tasks associated with such work need to be addressed using a set of modular, flexible systems. Put simply, higher levels of complexity place greater demands and thus potentially divergent requirements on technological solutions. On this basis, the theme of context sensitive technology aligns to the theme of mediated knowledge work. As complexity factors progressively increase, tasks alter and by association, so do the technological attributes required to process those tasks.

The findings suggest that the impact of progressively increased amounts of operational complexity drives a need for richer, more graphical representations of data. Within the research context, certain transactional data can be optimally represented as singular

records, contained in fields in a graphical user interface or within columns and rows in a table. The findings suggest that these particular data representations are predominant throughout the participant organisation. However, as information requirements become more complex, singular or tabular data quickly becomes cumbersome and difficult to navigate, affecting performance and end user experience. This particular observation has a level of support in the literature. Vessey (1991) submits that the manner and format in which information is presented to an individual is directly tied to task performance. Vessey's (1991) research compared tabular representations of data to graphical representations and sought to measure and account for any difference in task performance. Given the assumption that knowledge work is indeed shaped and transformed by underlying complexities, this characteristic within the cognitive theory literature has some very real implications for technological fit. For instance, how should a system respond to best represent progressively greater and more complex data sets? Put more simply, at what point should a system cease to represent a collection of data in tables and start to use richer, more graphical objects to convey meaning to a user? I raise these questions rhetorically, to highlight the considerable design issues posed to analysts, architects and developers alike in the development of technical solutions that address appropriate data representation.

Additionally, the findings suggest that greater complexity drives a requirement for greater collaboration (Trist, 1981), giving credence to the adage "a problem shared is a problem halved". Confronted with a new or unknown business requirement, an individual reaches out to a network of colleagues, who may have direct experience with the issue at hand or offer alternative methods of achieving a solution (Schrage, 1995). The findings indicate that these sense-making or problem-solving collaborations are spontaneous, highly case-specific and often transient in nature. That is, collaborative events are quickly established then abandoned once engagement is concluded and a satisfactory outcome is reached. Such collaborative events occur in a loose, informal set of social structures. These ad hoc interactions occur within the research context as local, face-to-face interactions, made possible through a shared, physical workspace. As such, the context of these interactions and the specificity of imparted knowledge strike me as the most significant factors when establishing the efficacy of using collaborative technologies. From a TTF standpoint, it seems unlikely that formalising these temporal interactions through a technological solution, such as a knowledge management system,

would yield a more efficient transfer of knowledge and thus a better fit outcome; a technological solution would likely impose greater structure and formality on those interactions and constrain the current collaborative dynamic.

As such, serious thought must be given to the logistics and intentions surrounding the codification and capture of particular knowledge. For example, what knowledge is worthy of codification and for what purpose? If the intent is information re-use, one must be sure that the knowledge captured is relevant and useful in wider business contexts. Relatedly, how long does one retain this knowledge in a formal technical system? Certain information may only be relevant for a comparatively small length of time. In contrast to these somewhat dissenting positions, the benefits of a knowledge management system would likely offer individuals the opportunity to engage with a wider array of organisational expertise, thus offering a potentially broader array of solution options.

System flexibility and personalisation are other technological considerations that the findings uncovered. The notion of system flexibility relates to the ease with which certain types of discrete changes can be made or alternative options selected within a system (Moses, 2010). In this sense, flexibility relates to the capabilities or features built in to a system, whereas the term adaptability connotes a more system wide, continuous and evolutionary meaning. Within my analysis, there appears to be a demand for two types of technological interaction: an improvisational, user-centric experience that accommodates those tasks related to the spontaneous nature of greater, emergent complexities and a process-oriented, standardised workflow or solution for more prescriptive, invariant tasks. The technologies actually used within the research context appear to emphasise only one of these two technological components. For example, the prevalence of word processing software applications to produce business documentation generally satisfies the need for flexibility, but these documents are not tied to or driven by a particular process or workflow system. Additionally, as the information entered into these documents is specific to and stored within each file, the data cannot be referenced or re-used by downstream processes, resulting in widespread re-keying. Interestingly, a study within the research context that proposed to measure fit as a function of utilisation would likely rank a word processing application as a high fit

technology – but this would not necessarily provide a full or accurate picture of technological fit.

The final insight associated with the theme of context sensitive technology relates to perceptions of where fit is located. Different knowledge worker roles seem to identify occurrences of fit or misfit in different areas of a system. For example, accounting roles, which use mostly numerically-based software to perform standard, predictable tasks, mainly focus on presentation issues; where data is displayed on screen or the order in which particular information is presented. This perception of fit occurs in the representational or surface structures of technology (Strong & Volkoff, 2010). Conversely, those roles which experience greater levels of task variability and which require integrated communication tools to perform job identify misfit within deeper and more significant areas of technology. Here, misfit appears as system constraints, missing integration and poor functionality, which are all examples of usability misfit, occurring in the deep structures of technology (Strong & Volkoff, 2010). Several participants lauded the use of dual screens in their work, allowing comparative tasks to occur without the need to continuously switch between applications. In these instances, technological fit occurs within physical technological structures (Strong & Volkoff, 2010). These particular observations not only validate the layered representation of technology submitted by Strong and Volkoff (2010) but they also suggest that fit is capable of shifting between these technological structures, depending on particular role contexts and user perception.

In sum, both my findings and the literature suggest that the presence and nature of technical artefacts have a direct bearing on the capability to change or adapt a system to meet end-user requirements and therefore affect the levels of technological fit in an organisation.

6.6 A theoretical review of mixed organisational support

The theme of mixed organisational support focusses on the firm as a causal agent of technological fit or misfit. To this end, the findings indicate the presence of two contending conditions in the participating firm's organisational structure. On the one hand, the evidence suggests that a high level of local managerial and technical support exists within the subject firm. Conversely, the international management layer is seen as

indifferent to and disconnected from the needs of the local operation. The central question to address in respect of this theme is this: does a conflicted management structure have an effect on technological fit? Several examples from the findings suggest that it does.

A number of participants noted the presence of various unrelated and unintegrated technologies within the research context, which is suggestive of a “point solution” problem (O’Callaghan, 1999). The presence of point solutions indicates the widespread array of individual software tools either developed or purchased and introduced into the organisation over a period of many years on an application-by-application basis to perform different functions. These solutions pose issues with regard to uncontrolled management and maintenance, disparate or localised customisation and a general lack of organisational understanding about what they do. The point solution problem occurs as a function of poor management – where expediting a pressing business need with a one-off application trumps a longer term, strategic solution, which better aligns information technology imperatives with a cogent business strategy (Broadbent & Weill, 1997). Evidence of a widespread point solution issue in an environment may indicate a form of management that is more concerned with short-term fixes rather than addressing long term, sustainable and strategically-aligned technologies.

In addition to the identified point solution issue, the various disconnected and monolithic technologies used in the research context may also be regarded as legacy systems, which are usually defined as dated, stand-alone software applications (Ulrich, 2002) in which the organisation has a long-standing and substantial vested interest (Connall & Burns, 1993). It is useful to delineate between point solutions and legacy systems. Where a point solution issue is distinguished by a large number of unrelated, tactical applications, legacy systems are often more singular, entrenched and integrated within a business, making them difficult to remove or modify to better reflect changing operational processes or business requirements.

The co-existence of point solution issues with legacy system issues in the participating firm may be related. The fear of uncertain outcomes or economic drivers may create reluctance within management to migrate away from older, entrenched legacy technologies and, instead, advocate for the less risky option of developing several

smaller peripheral applications to meet business requirements. As such, the presence of point solutions and legacy systems in the participating organisation tends to emphasise a central issue with management and the overall suitability of technological directives.

There is further evidence of management issues related to technological use contained in the findings. Negative views were raised by several participants whose roles required the use of an enforced decision support system (DSS). The main criticisms of the participants related to the irrelevant nature of the DSS and its mandated use. The main motive behind the deployment of the DSS seems to be political, rather than addressing an actual technological need. This approach to technology may be viewed as paternalistic and has the potential to have quite harmful organisational outcomes, including distrust and end user cynicism.

Given these findings, it seems reasonable to assume that the managerial and organisational factors encountered in the research context do have a significant part to play in the causality of technological fit. However, the IS literature appears to be less absolute about the organisational influences on technological outcomes (Kling & Zmuidzinas, 1994; Markus & Robey, 1988).

Markus and Robey's (1988) research into the effect of organisational factors on technological outcomes classifies causal agency into three groups: the technological imperative, the organisational imperative and the emergent perspective. Within the technological imperative, technology is viewed as a causal force in its own right, external to the enclosures of an organisation, which imposes itself and influences the nature of an organisation. It is a view that is highly deterministic and is a position often championed by certain socio-technical theorists (Mowshowitz, 1976). The logical antithesis to this view is the organisational imperative, which advocates that technology is a tool, the nature of which is controlled by the rational intention and deliberate actions of human actors within the firm. It is a view that positions technology as an organisational resource or an artefact, which can be treated as a simple dependent variable. Tellingly, Markus and Robey (1988) point out that, in spite of compelling theoretical arguments supporting either side of the argument, the weight of empirical evidence firmly supporting one or the other view is limited. The third view of causal agency is the emergent perspective, which maintains that the relationship or association

between technology and an organisation is unclear and unpredictable. The central concepts that underpin an emergent perspective relate to the potentially random interplay that occurs between technologies and organisations such as the choice and use of technological infrastructures and the potential for non-rational, conflicted or mixed operational objectives. In other words, forces external to the organisation mix dynamically with the varied internal motives and interests of actors in that organisation to produce unpredictable outcomes (Pfeffer, 1991). Thus, Markus and Robey (1988) suggest that the traditionally antagonistic views of the technological and organisational imperatives show little in the way of conclusive empirical support and an emergent perspective provides a possible conciliatory middle way – where neither the organisation nor technology exclusively act as the centre of causation.

Further support for an emergent perspective is provided by Kling and Zmuidzinas (1994) who advocate that there is no single dominant trend when examining the effect of computerisation on workplace transformation. In their study, Kling and Zmuidzinas (1994) highlight that the effects of computerisation in an organisational context are non-uniform, non-linear and pluralistic, leading to differential impacts mediated by implementation strategy, managerial ideology, the nature of the roles affected, the power attributed to those roles and the degree of technological integration within the participating organisation.

Overall, the literature provides little in the way of definitive theoretical evidence to support a ‘better firm – better fit’ proposition (Markus & Robey, 1988; Pfeffer, 1991). However, it should be noted that the literature is not suggesting that organisational factors are incapable of producing particular fit outcomes. Rather, it suggests that technological fit outcomes cannot be absolutely and exclusively ascribed to organisational agency alone.

6.7 Causes and constraints of technological fit

Having discussed the theoretical merits of each causal theme, I complete this research by evaluating and establishing how each theme contributes to fit causality. To achieve this, I provide a series of hypothesised and inferential explanations of each theme, which describe how each theme influences fit causality. These explanations are then pieced together to form an overall critical realist conception of technological fit.

Based on my findings, no one theme provides a singularly causal explanation of technological fit. All themes appear to act in concert, to varying degrees, to influence technological fit outcomes. However, a certain logical order is apparent in each of the four causal themes, in terms of their relationship to one another.

Firstly, the theme of mixed organisational support frames the organisational context within which all other causal themes occur. The theme of mixed organisational support partly relates to observations of disconnected management, technological underinvestment and poor strategic alignment between a business and its technology choices. These prevailing structural conditions are assumed to exert a constraining influence over the technological strategy of the participating firm and negatively impact upon improved fit outcomes. The literature indicates that supportive management, access to generous amounts of capital and well-aligned business-technology partnerships are not absolutely predictive of optimal fit outcomes (Markus & Robey, 1988), but it is reasonable to assume that the probability of achieving better fit outcomes improves with their presence.

The next aspect to explore is the relationship between a task and a technology. I contend that a tool or technological artefact derives its existence from a task. Conversely, the performance of a task may or may not be actioned by a tool; a stance which is borne out through the theme of implicit industry knowledge. Based on this observation, we can say that tools are subordinate to tasks. It follows, therefore, that the nature of a task must be understood before a tool can be developed to address it. This position suggests that a priority must be placed on obtaining a full understanding of the task requirements and the complexity factors that create task variances.

Once the task is understood, one must address how to optimise the execution of that task. Here, the theme of implicit industry knowledge enters the picture by illuminating how knowledge workers approach complex tasks and form value-based judgements, which, in turn, provides the potential to codify tacit knowledge related to analysable tasks.

Together, these learnings then need to be accurately represented within a technological artefact. The processes and procedures related to knowledge work tasks need to be

accurately represented within a flexible, integrated and graphically-rich enterprise solution, which can be easily personalised to meet individual task requirements or adapted to meet on-going changes to operational conditions. Assuming that the tasks requirements are accurately migrated and faithfully represented within a scalable technological platform, the technical solution will absorb certain task characteristics and complexity dimensions. Figure 6-2 represents the relationship between these thematic components.

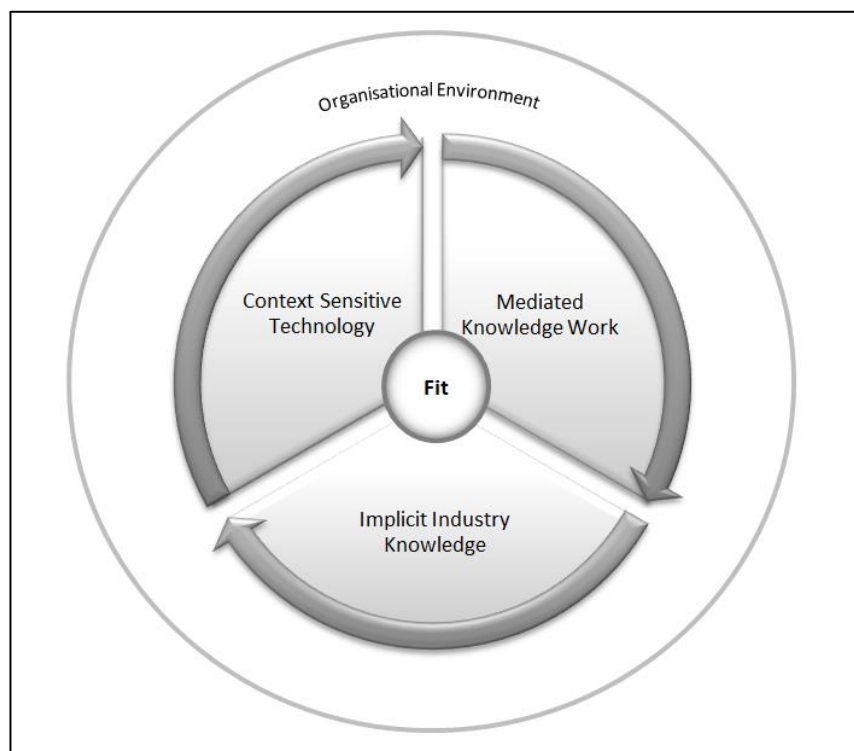


Figure 6-2: Conceptual model of the causal themes of technological fit

A hypothetical explanation of fit causality begins to form at this point. Firstly, these observations, together with the TTF literature, indicate that fit is brought into existence at the point a technical artefact interacts with the knowledge work task. This interaction point is where fit actualises itself as an observable phenomenon, and it is the area where experimental or diagnostic studies related to TTF focus. Whilst fit is made manifest through this so-called task-technology interaction, its presence occurs as a result of earlier design and development efforts. I propose, therefore, that technological fit is caused through a combination of human and technical agency. It is brought into existence through human capabilities, which include the ability to accurately articulate a highly nuanced knowledge work task, draw out how various individuals resolve, calculate and mentally manage that task and then transfer the task into a formal, suitable

technological representation. The involvement of a supportive, well-resourced organisational environment helps to enable these steps.

Expressed within a critical realist ontology, the elements of human cognition, shared understanding and creative design form the essential and initial entities or structures of technological fit, with organisational structures acting as either constraining or supportive generative mechanisms. These fundamental elements occur in the so-called real domain. Fit is brought into existence as an event in the actual domain and observable actions, such as task performance, occur between people and the tools they use within the empirical domain. Figure 6-3 represents this critical realist model of technological fit.

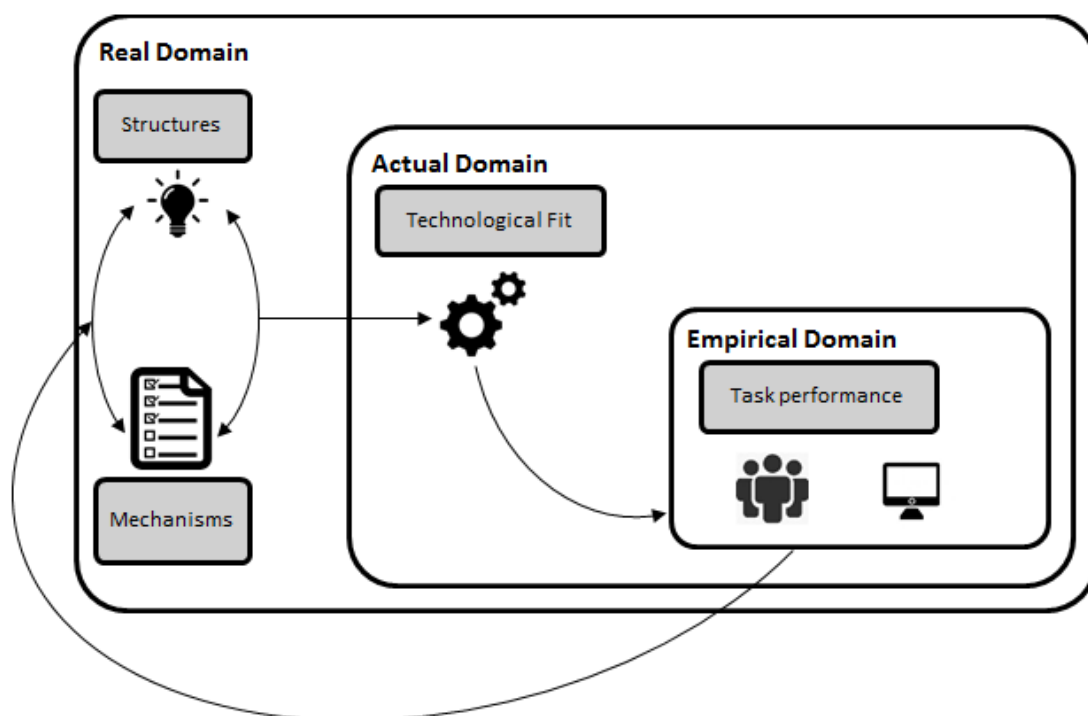


Figure 6-3: Critical realist model of technological fit

Both conceptual models presented in Figures 6-2 and 6-3 indicate that the nature of technological fit has a cyclical characteristic to it – an observation that has theoretical resonance with other IS research (Henfridsson & Bygstad, 2013). Importantly, the use of technology feeds back on and alters the nature of the knowledge work task it actions. Greater levels of fit, brought about thorough an accurate representation of the task, ought to lessen the effect of certain task attributes and related complexity factors, which will impact how knowledge workers approach and action the revised task, which in turn impacts on the nature of the technology. This proposed recursive characteristic offers a

potentially interesting dynamic in terms of the overall TTF theoretical model. It is assumed that an absence of technology or low levels of technological fit forces a proportionately greater involvement and dependency on the human actor to execute a task. As knowledge converts from implicit to explicit, thereby moving knowledge away from the mind towards the machine, the performance of that task is increasingly met by technology and the presence of the human actor diminishes commensurately. Whilst conjectural, the implications of such a view are potentially profound. It suggests that technologies are capable of progressively better reflecting task requirements, introducing a fit dynamic between tasks and technologies; a form of adaptive potential that is supported by the IS literature (Arthur, 2009; Henfridsson & Bygstad, 2013).

More significantly, migrated knowledge work, and associated improvements in fit outcomes, would have a direct human impact. In technologically impoverished workplace environments, improvements to fit would likely result in beneficial outcomes, such as higher measures of performance and end-user satisfaction. Routine, unfulfilling and laborious work previously performed by people would be delegated to technology, which would free up human actors to pursue more rewarding and creative work. However, advances to technological fit that tend toward complete mechanisation and automation of the workplace have the potential to adversely impact individual human actors or entirely displace affected roles. Framed as such, movements of technological fit may exhibit either utopian or dystopian workplace effects, depending on environmental workplace conditions and context.

6.8 Chapter summary

The findings of this research indicate that four overarching themes contribute to fit or misfit outcomes: a supportive and strategically-aligned organisational environment; the use of suitably flexible, adaptable technologies that accurately reflect tasks; the capability to explicate and codify particular implicit knowledge and a sound understanding of varied knowledge work tasks.

Fit is not something we actually see but we observe the effects of it. It makes its presence felt in the interaction between human actors, the tasks those actors are required to perform and the technologies selected to execute those tasks. Fit is fashioned out of human creativity and resourcefulness. Its genesis is initially cognitive, caused through

the level of accuracy, sensitivity and interpretation brought on by the understanding and imagination of human actors. Those ideas must then be turned into a reality – whether that reality be a tangible object or an intangible one. Fit causality, therefore, is presented as a combination of human and technical agency. It first requires a shared understanding of tasks and the capabilities of experienced and expert human actors who perform those tasks. Once understood, these work concepts need to be accurately transposed into suitable technological tools.

During the literature review, I pondered what zero or complete fit conditions might look like. To answer this, it is useful to think of how a task can be performed. A task may be an activity performed completely by human agency, completely by technological agency or, most likely, some combination of both. Examples of tasks performed completely and solely by humans include manual tasks, like walking, moulding clay or cupping your hands to gather water, or cognitive tasks, such as reflecting, calculating or imagining. Conversely, tasks performed completely by technology include fully automated processes, such as a mechanised production line, a software agent or a service daemon.

Technological fit actualises itself once a tool is used to help perform a task. If technology is absent or is not utilised to perform a task, task performance occurs entirely by human involvement, creating a theoretical zero-fit state. What does complete fit look like? It is the logical antithesis of a zero-fit state. It is a state where the performance of the task is completely met by the technology, with a commensurate and total absence of any human involvement in the performance of that task. Most often, task performance occurs through a combination of human and technological agency, implying that fit positions itself somewhere between these two extremes and may shift between these points over time, as environmental conditions change.

My essential criticism of many interpretations of TTF theory relates to the conspicuous absence of human representation. The irony of this portrayal of the TTF model is that neither tasks nor technologies are capable of existence without a human presence; they are artefacts incapable of sustaining their own existence. In the Methodology chapter, I referred to a common critical realist thought-experiment used to support the proposition of an intransitive reality. Given an imagined world where people, somehow, instantly

vanish, critical realism argues that the natural order of things simply continues on. The logical extension of this argument suggests that all elements related to human experience and existence would also vanish with us. As such, tasks disappear and technologies – at the least the physical manifestations of them – would lay idle and eventually atrophy. Tasks and technologies are essentially human, and theoretical models which do not in some way acknowledge this relationship appear to me to be incomplete.

The inclusion of human representation within the TTF theoretical model allows us to better identify how technological fit comes about. Additionally, my findings present technological fit as an occurrence within a whole system, where individuals, organisational structures, tasks and technologies exist as inseparable, interdependent and mutually constituted elements that co-exist and act on one another (Archer, 1995).

Chapter 7 Conclusion

This study set out to explain the causality of technological fit, based on the nature of the relationship that occurs between people, the tasks they perform and the tools they use to perform those tasks. Using the Task-Technology Fit (TTF) model as its theoretical framework, this study concentrated on a specific organisational context, a so-called 'knowledge work environment', in the form of a regional office of a large, multi-national insurance broking firm. A review of the TTF literature revealed several interesting aspects related to its application in past research efforts. Firstly, as a model, TTF appears to be capable of wide adoption and interpretation evidenced by the use of numerous theoretical definitions, measurement methods, conceptual models and units of analyses. Secondly, the literature suggested that TTF is often used in quantitatively-based, technically deterministic ways and is usually applied to specific task-technology settings. The emphasis on these highly specific and deductive lines of inquiry revealed a potential gap in terms of more holistic and interpretive perspectives related to TTF studies. Furthermore, the literature revealed a paucity of causally-related TTF research. As such, this study sought to uncover the underlying conditions or causal mechanisms of fit or misfit and was directed by the following central research question:

What are the fundamental mechanisms that cause fit to occur between tasks and technologies?

To advance this research question further, the individual components of the TTF model were explored more intensively. Theoretical definitions and explanations were derived to address the notions of fit, tasks, technologies and, in order to frame the research context, the topic of knowledge work was also broadly discussed and theoretically defined. In order to conduct causally-focussed research, thematic analysis was utilised, which was embodied within the philosophical position of critical realism. The appropriation of thematic analysis and critical realism provided two important benefits to this study. Firstly, both offered a sound methodological basis within which to direct research that is primarily concerned with causal explanation. Secondly, both have a well-established pedigree in Information Systems (IS) literature, with numerous past

studies offering practical suggestions and examples related to the actual utilisation of thematic analysis methods and critical realist principles.

The findings of this research culminated in four potential themes of fit causality: mediated knowledge work, implicit industry knowledge, context sensitive technology and mixed organisational support. The theme of mediated knowledge work relates to the variation of knowledge work tasks caused by numerous contingent complexity factors. The second theme found was implicit industry knowledge, which indicates a reliance on individual expertise, stored knowledge and experience to address knowledge work tasks. Task analysability was an identified link between mediated knowledge work and implicit knowledge. An increase in knowledge work complexity results in the commensurate increase in creativity, innovation and individual judgement-making; elements which are most often met through human expertise and which are challenging to correctly codify and represent in a digital format. As such, and in the absence of a technical solution, human actors align closely with a complex task via implicit industry knowledge. The third theme identified was context sensitive technology. Knowledge work shifts in line with underlying client and end-user needs. This spawns a requirement for different technological modalities to perform the tasks. That is, complexity factors appear to drive a demand for alternative degrees of technological functionality. The fourth theme found was mixed organisational support, which presents the firm as a causal agent of technological fit.

These findings were synthesised and several essential outcomes became apparent. Firstly, all four themes share a dynamic, recursive and inter-related association and all contribute to technological fit to varying extents. The nature of mediated knowledge work tasks impacts upon human actors in the form of implicit industry knowledge, which affects technological capabilities, which reflect back on knowledge work tasks. The organisational context sits across and influences the inter-relationship of the three other themes.

The central mechanisms of fit causality were found to be both social and technical. Technological fit firstly requires an understanding of task requirements, complexity factors and the mental methods used to resolve complicated tasks. It equally requires a technical capability to optimally represent these work concepts in a suitable technological form. As such, human creativity and technical expertise create

technological fit, firstly through the process of mental conception and then by actualising those ideas by creating or altering a representative solution to address the task. In workplaces where poor technological fit is replaced by higher levels of fit, perceptions of job enrichment, higher performance and increased productivity may well be observed. However, a state of full or complete technological fit would likely disrupt and displace roles performed by human workers.

From an academic point of view, this study sought to continue a specific discussion related to IS theory and re-introduce certain human capabilities into the TTF model. In doing so, this research adds to the current TTF literature in two ways. Firstly, it presents technological fit as an evolving, progressive phenomenon, which shifts and re-aligns based on changing work contexts, human needs and improved technological architectures and designs. Secondly, the findings of this study extend the current TTF literature with the suggestion that fit causality is fundamentally social and more human-centric than many of the current theories on TTF indicate. To be clear, these insights are not intended to dismiss or challenge the empirical findings of earlier, deductively-based studies related to TTF. Rather, the intent is to augment these earlier studies with a revised, dynamic and more human perspective of TTF theory and serves to remind us that organisations, tasks and technologies are respectively formed, performed and developed by people.

This study may also provide benefit to those involved in the design, development and management of knowledge work-centric systems. In particular, the hope is that tools are developed more effectively, to meet the increasingly personalised nature of work evident in knowledge working environments. It should also be acknowledged that the price payable for greater levels of technological fit may be more social than financial.

7.1 Future research avenues

Within this study, I have raised the possibility that fit can be positioned along an imaginary continuum, where the states of zero fit (totally manual work) and full fit (totally automated work) occur at opposite ends of the fit continuum. Of potential interest is whether such a fit model is valid and, if so, whether fit is capable of shifting its position along this continuum, based on changes made to established technologies. Furthermore, this research suggests that human representation forms a vital component

of the TTF model. This expanded view of the TTF model provides several avenues for suggested future research. For example, is it valid to express fit as the relative proximity between a task, a technology and the involvement of a human actor? If we accept that fit is a dynamic phenomenon that varies over time, what impact do these shifts have on affected human actors? Do improved fit outcomes really have the potential to displace jobs? Alternatively, one may choose to test the theory that human actors are progressively positioned further away from a task as tacit knowledge gives way to explicit knowledge. Additionally, one may test whether the dimensions of a task actually do diminish as a function of their incorporation into a technology. For the most part, these suggested research avenues would ideally occur through deductively-based, longitudinal case studies, each defined by a set of suitable hypotheses to test against.

This study concentrated on a very specific workplace to derive its data. Such specificity of context makes the generalisation of the research findings difficult. Furthermore, the analysis of data and the derivation of causal themes all resulted from the individual effort of a single research-practitioner. Whilst every effort was made throughout the study to avoid introducing the spectre of personal bias, its potential existence in the results must be acknowledged. Finally, whilst it is hoped a dynamic model of TTF will have appeal outside the confines of this research context, its conception is contextually-specific and the findings largely inferential. As such, a level of caution needs to be exercised in its appropriation within other studies.

In summary, this study adopted a fundamentally critical realist position to determine causal mechanisms of fit. In uncovering these causalities, the study findings indicated that a more dynamic aspect appears to apply to the TTF model, which is conventionally viewed in mostly static, invariant terms. Observations of workplace interaction suggest that people learn, tasks vary, organisations and technologies evolve over time. By implication, studies that explore socio-technical interactions ought to reflect the fluid, dynamic and progressive nature evident in actual organisational contexts. In achieving its initial objective of revealing fit causation in a specific research context, a fresh perspective of existing TTF theory is revealed, which offers potential to those involved in IS research as well as system technicians and managers more generally.

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Appendices

Appendix 1: Information sheet

Participant Information Sheet



Date Information Sheet Produced:

Monday, 23 March 2015

Project Title

Causal Structures of Task-Technology Fit in a Knowledge Work Environment

An Invitation

My name is David Brown. I wish to invite you to participate in a workplace study I am conducting as part of my Masters degree.

The study explores the nature of what you do as a knowledge worker, what technologies you use to perform your tasks and how you deal with difficult, complex or untried work situations. A more detailed outline of the study is provided in the sections below, but I would like to conduct a series of interviews that address these issues.

Participation in these interviews is completely voluntary and you may withdraw your participation at any time. The interview process will be treated in complete confidence and any personal or commercially sensitive information mentioned during the interview process will be redacted from the study results. Also, any information gathered during this process will be used solely for the purposes of this study – nothing more.

What is the purpose of this research?

This research seeks to explain how technology is represented within our organisation and more broadly throughout the insurance industry. In an effort to answer this question, I need to identify the things that influence what you do, the tools you use to complete these tasks and how closely these two things align.

In particular, I am interested what makes your day-to-day tasks “complex”, what makes your clients “complex”, how you decide on certain knowledge work tasks (insurance programme design, captive structure, carrier representation, how you compare terms etc.) what technologies you use to perform those tasks, why those technologies are used and how effective you feel these technologies are.

My objective is to identify the central influences or “*causal structures*” of knowledge worker tasks and the technologies they use and apply them to a working, theoretical model.

As mentioned in the opening comments, the results of this study will form the basis of a Masters degree thesis.

How was I identified and why am I being invited to participate in this research?

Part of the study looks at the how the nature of your job alters based on the type of tasks and technologies used in your role as a “knowledge worker”. Knowledge work involves taking information and re-shaping it to the benefit of clients using a combination of experience, innate knowledge and technology.

I want to develop a series of case studies based on different knowledge worker roles. To do this, I need to get representative views from various practices or business units in the organisation. I aim to get comments from experienced insurance brokers from various disciplines such as the commercial, corporate, construction and financial services practices as well as risk control, captive management and possibly re-insurance.

This study requires that:

- Your role involves knowledge work and that you work in one of these practices;
- You have a minimum of three years’ experience in that role and;
- You are familiar with the technologies normally associated with that role.

As a work colleague, I already have a general understanding of what your role entails within the organisation. Based on this understanding, as well as the study requirements outlined above, I believe you have the necessary skills, experience and background to assist with this topic of research.

What will happen in this research?

Data for these case studies will be obtained during an interview between us. Notes taken during the interview will be written up in the form of minutes. If you wish to review a copy of these minutes I will provide a copy to you. You will have the opportunity to make any changes and add additional comments you deem necessary at this point.

I will use your comments to identify themes related to the central questions the study seeks to explain. The study may quote certain things that you say but your personal details will not appear in the final report and any comments attributed to you will be anonymised.

What are the discomforts and risks?

The interviews will be conducted in a relaxed, relatively informal manner at a time and place convenient to you. You may cease the interview at any time – no questions asked. Also, whilst I am interested in your personal reflections, the topic of conversation will be business-related and is not intended to draw out themes of a personal nature.

What are the benefits?

As a participant you will have the opportunity to discuss issues relevant to your role.

As a researcher I will gain valuable experience both in undertaking research and presenting the findings within a Masters level thesis.

More broadly, the research findings will hopefully benefit both the academic and business communities alike.

How will my privacy be protected?

As mentioned above, the results of this study will be treated in complete confidence. Summaries of interviews will be anonymised and your personal details will not be used within the research. Interview notes and consent forms will be stored securely, off-premises for a period of six years, after which time the physical files will be destroyed.

What are the costs of participating in this research?

It can be difficult to gauge how long a discussion or interview may take – I estimate between 30 - 40 minutes of your time may be required.

What opportunity do I have to consider this invitation?

You are not obligated in any way to participate in this study. Your involvement is completely voluntary.

If you are interested in participating in this study, please confirm your interest to me via e-mail at (address redacted) by 1 June 2015.

Selected participants will be issued formal Consent Form. Once your consent is obtained, a date and time that suits you will be arranged.

Will I receive feedback on the results of this research?

A copy of the final research results can be made available to anyone interested.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr. Antonio Diaz Andrade, antonio.diaz@aut.ac.nz, +64 9 921-9999 – extension: 5804

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTC, Kate O'Connor, ethics@aut.ac.nz, 921 9999 ext 6038.

Whom do I contact for further information about this research?

Researcher Contact Details:

David G. Brown
+ 64 9 356 9345

Project Supervisor Contact Details:

Dr. Antonio Diaz Andrade
antonio.diaz@aut.ac.nz
+64 9 921-9999 – extension: 5804

Approved by the Auckland University of Technology Ethics Committee on 20 May 2015, AUTC Reference number 15/144.

Appendix 2: Interview guide

INTERVIEW QUESTIONS & RESPONSES

Date:

Participant Name:	
Role:	
Gender:	
Time spent in current role:	
Industry Experience:	
Time Interview Commenced:	
Time Interview Ended:	

INTRODUCTION

Summarise the objective of the research and outline the topic of Task-Technology Fit. Explain the general format of the interview. Reiterate that the interview is voluntary, confidential and may be terminated at any stage if the participant requires.

SECTION 1 – General Questions

Describe your role and summarise the main tasks you perform in that role?

--

When you come into work each morning, do you usually know beforehand what you need to do or is it largely unknown?

--

Do you feel your role requires a certain amount of creativity or innovation? Explain.

--

Do you feel your role involves a certain amount of your own personal judgement or decision-making? Describe this.

--

How many clients do you presently look after?

In terms of the clients you look after, are there any that stand out as being particularly complex or difficult? What makes them complex or difficult?

--

Assume you are presented with a new client and you know nothing about their business. How do you know which questions to ask that adequately reflect their needs?

--

Describe how you might handle situations where a policy is particularly difficult to place, perhaps due to size or the nature the clients business. How do you decide which markets to approach? How do you know what represents good terms for the client?

[illegible]

If the role is non-customer facing, ask the following:

In terms of the tasks that you perform, are there any that stand out as being particularly complex or difficult? What makes them complex or difficult?

Have you noticed changes to your role since you commenced it? Describe these.
SECTION 3 – Technologies
Thinking about the technologies you use to perform your tasks, which one do you use most often?
Why do you use these technologies?
Are these tools adequate for you to perform your tasks? (for customer-facing roles, specifically obtain views on <i>DSS</i> and <i>broking system</i>)
If you could build your own system, what would your ideal technologies look like? What would they do differently from the present offering?

How might this ideal set of new technologies affect your current role?
SECTION 4 – Organisational Structure
Do you think your role is well-understood throughout the organisation? Explain.
Do you think the organisation provides a suitable level of managerial support and assistance for you to be effective in your role? Explain.
Do you think the organisation provides a suitable level of technological support for you to be effective in your role?
Is it important to you that those involved in management or IT support roles understand what you do?

Why? Why not?

Appendix 3: Sample layout of grouped transcript data

Question 1. Describe your role and summarise the main tasks you perform in that role?

Case	ID	Response	Codes
Account Director	1.1	I look after 2 large energy programmes for a single client. Day to day service “ <i>it is service-heavy. I am at the clients premises 2 to 4 times a week</i> ”. The renewal strategy lead in time for this client starts 6 months out from the renewal date.	Strategic Servicing
Corporate General Broker	1.2	Client and carrier interaction to provide an insurance solution to the client.	Solution-focussed interaction
Captive management consultant	1.3	This is a difficult question to clearly answer. The role used to be primarily comprised of accounting duties, with 75% of time devoted to these activities. The tasks are now considerably more varied, with no more than 25% of my time spent on any one task. The role has become consultative. It is varied, highly unique and every case is different. There are common things with the role – it deals with risk and insurance. The variance or diversity of work comes down to the occupation and location of the client. The role also requires managerial oversight of published account production – perhaps 15% of the role is taken up with these duties. There are our own compliance requirements to attend to, such as regulatory filings for clients, checking to ensure legislative compliance is maintained. The role requires knowledge of the laws and tax regimes of various countries, including New Zealand, Australia, Vanuatu, Bermuda and Singapore.	Specialised Financial Consultation
Specialist Broker	1.4	General insurance broking duties – placement of liability insurance programmes and claims handling	Transactional interaction
Re-insurance Broker	1.5	Facultative re-insurance broking. I deal with arranging re-insurance placements on behalf of clients or cedents together with the associated administration and processing of these arrangements. I have been both an insurance broker and a re-insurance broker. Both are pretty similar in terms of processing requirements. All re-insurance transactions are arranged based on the underlying policy agreed between the client and insurer. The re-insurance transaction generates quote and placement slips, just like retail insurance. We use these slips to approach re-insurers and these largely reflect the contractual conditions of the underlying policy. Additional terms and conditions can be imposed on the transaction by subscribing re-insurers.	Transactional interaction
Accountant	1.6	It all revolves around month-end reporting. I summarise each month in a format prescribed by (subject firm). It’s pretty standard stuff and it requires us to categorise revenue, profit and loss statements, balance sheets and the like. Conceptually, it’s quite straight-forward.	Formatted and procedural
Commercial Retail Broker	1.7	The role involves client account management which involves renewal of existing client insurance programmes, claims management and policy amendments. We also have a strong sales focus, so we deal with prospecting for new clients, arranging new business strategies and performing risk analyses for start-up companies.	
National Corporate Manager	1.8	The role is very broad. It involves looking after clients and staff. It involves maintaining a senior relationship position with several large clients. It involves managing various internal and organisational interests at a national level.	Relationships

Question 2. When you come into work each morning, do you usually know beforehand what you need to do or is it largely unknown?

Case	ID	Response	Codes
Account Director	2.1	I usually know what I need to do, but things can change overnight Especially from our overseas network partners who may need additional information or may wish to share information that is pertinent to my client. Sometimes I get requests for information from within the network. "Has anyone come across this before?" There is a lot of post-renewal activity that needs to be tidied up.	Planned with a certain degree of unpredictability
Corporate General Broker	2.2	90% is known of planned for. 10% is a response to unplanned requirements. Experience helps with predicting requirements. It helps narrow down the number of unexpected events.	Planned with a certain degree of unpredictability. Experience lessens unpredictability
Captive management consultant	2.3	It can be planned but <i>"there's a lot that pops up."</i> Perhaps half the work is foreseeable, the other half random. Because there is an accounting focus to the role, key dates drive a lot of the tasks and activities but phone calls and interruptions are often received from clients, banks, auditors and so on.	Planned with a certain degree of unpredictability
Specialist Broker	2.4	Half and half. We know our clients deadlines. But day to day it is largely determined by outside factors like client and carriers who call.	Planned with a certain degree of unpredictability
Re-insurance Broker	2.5	For the most part I know what I need to do	Planned
Accountant	2.6	50:50. We have a monthly timetable prepared in advance, so we can plan for submitting GST or FBT returns, that sort of thing. But there are things that crop up that are quite ad hoc that require problem-solving.	Planned with a certain degree of unpredictability
Commercial Retail Broker	2.7	I'd like to say the former but it is probably the latter!. We usually have an idea about what we need to do – we have 4 – 5 planned activities we have to attend for the day. But things can get quite unstructured – things just come your way. Because of e-mail I am more accessible and therefore there are a lot more interruptions. So we juggle between dealing with new issues and catching up on planned tasks. People tend to deal with the easy things and put off the difficult ones – I guess that is just human nature. But that can lead to problems. Time management and learning how to prioritise are big things with us.	
National Corporate Manager	2.8	I always have a plan. I use the electronic diary and check it to assess the next days planned activities. But that can turn to custard in a second – usually as a result of a pressing client issue. <i>"Clients always take precedence over internal issues"</i> .	Planned with a certain degree of unpredictability Client issues a priority

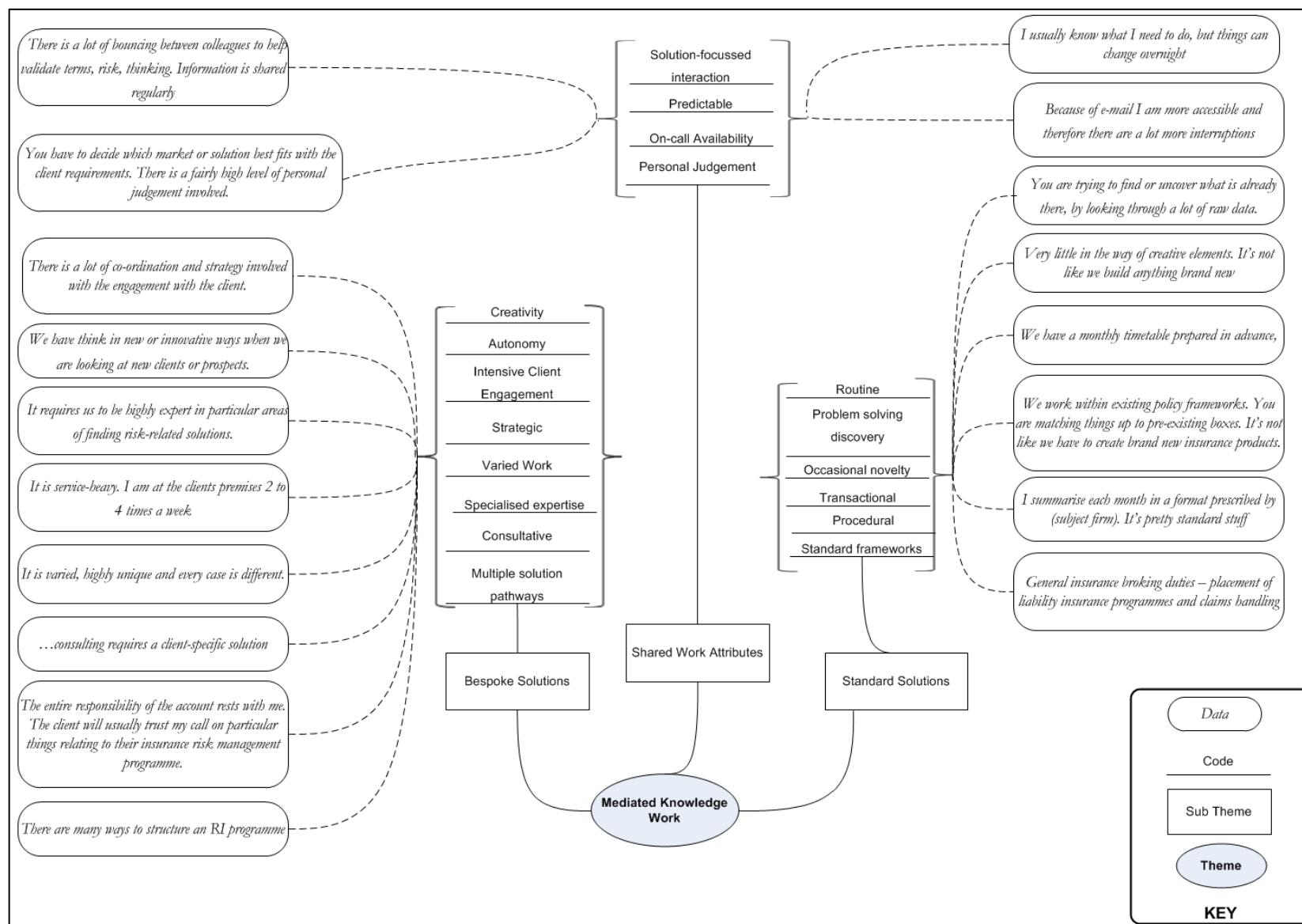
Appendix 4: Table of final codes

Index ID	Code	Sub theme	Theme
5.1, 5.2	Complex business models	Complexity sources	Implicit Industry Knowledge
5.2, 5.4, 5.7	Business diversity	Complexity sources	Implicit Industry Knowledge
5.3, 5.8	Informational loads	Complexity sources	Implicit Industry Knowledge
5.4	Contingent complexities	Complexity sources	Implicit Industry Knowledge
5.4, 5.5	Hazards	Complexity sources	Implicit Industry Knowledge
5.4, 5.8	Client amenability	Complexity sources	Implicit Industry Knowledge
2.2,6.1, 6.2, 6.7, 6.3, 6.8, 7.2, 7.5, 7.7, 7.8	Background knowledge	Complexity treatment	Implicit Industry Knowledge
3.2, 6.1, 6.8, 7.1, 7.2, 1.8, 4.1, 7.4,7.5, 7.7, 7.8,11.1,14.1	Established Trusted Relationships	Complexity treatment	Implicit Industry Knowledge
4.2, 4.4, 7.1, 7.4	Comparative judgements - optimal choices	Personal Judgement	Mediated Knowledge Work
4.3, 4.5, 4.7, 4.8, 7.1	Interpretive judgements - legislation	Personal Judgement	Mediated Knowledge Work
4.6	Relative judgements - numeric	Personal Judgement	Mediated Knowledge Work
7.2	Intuition	Complexity treatment	Implicit Industry Knowledge
1.1, 1.7, 3.1, 6.1, 6.3, 1.3	Strategic consultation	Unstructured Work Attributes	Mediated Knowledge Work
1.3	Varied work	Unstructured Work Attributes	Mediated Knowledge Work
1.3, 3.8, 5.8	Specialised expertise	Unstructured Work Attributes	Mediated Knowledge Work
1.1, 13.8, 3.1, 2.8, 7.7, 13.8	Intensive client engagement	Unstructured Work Attributes	Mediated Knowledge Work
3.3, 13.8	Creativity	Unstructured Work Attributes	Mediated Knowledge Work
3.5	Multiple solution pathways	Unstructured Work Attributes	Mediated Knowledge Work
1.2, 3.3, 5.8, 7.1, 7.7	Solution-focussed interaction	Structured Work Attributes	Mediated Knowledge Work
2.1, 2.8, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7	Predictable with external interruptions	Structured Work Attributes	Mediated Knowledge Work

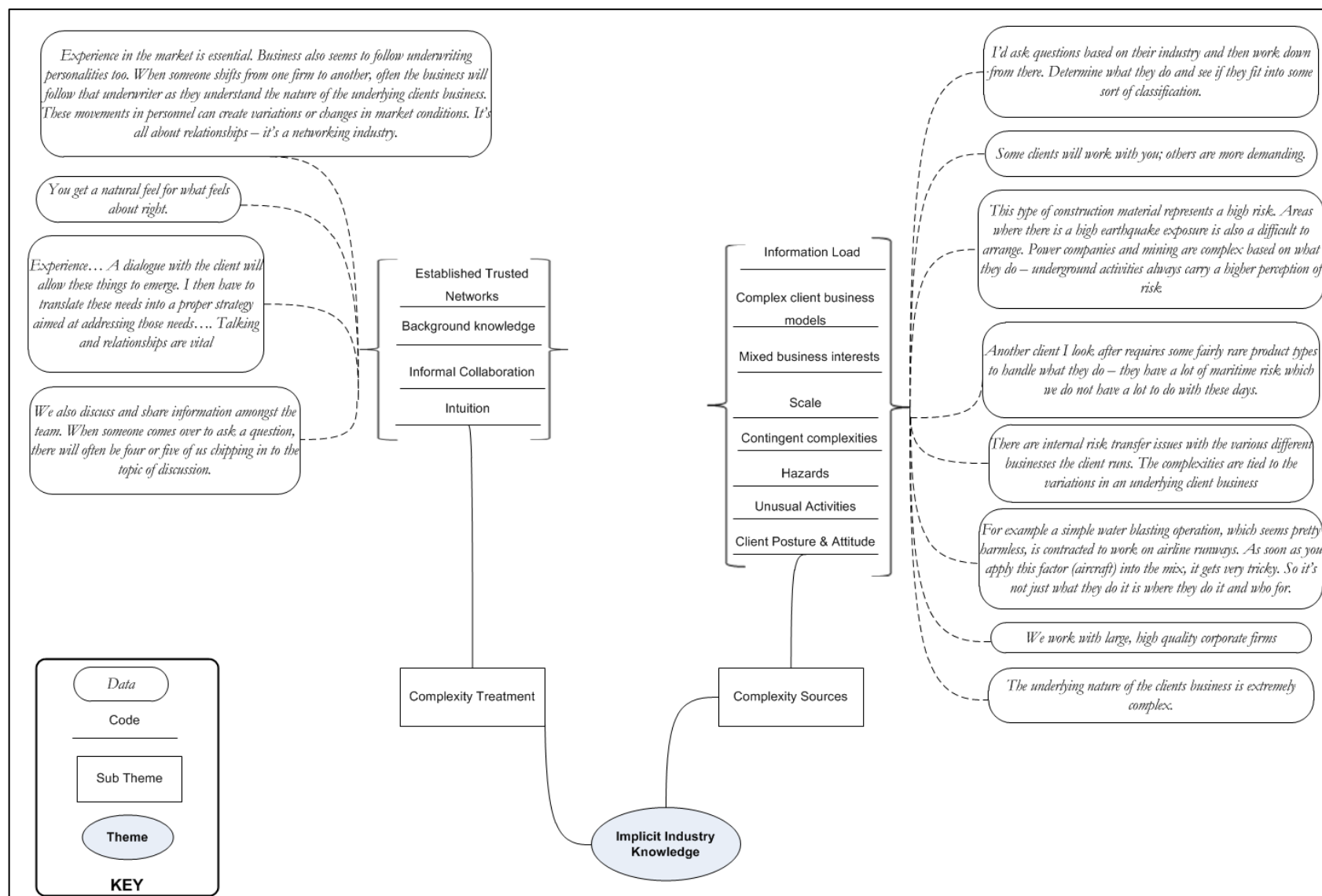
2.7	On-call Availability	Structured Work Attributes	Mediated Knowledge Work
3.8, 7.2, 7.4, 7.8, 11.1, 12.5, 16.5	Informal Collaboration	Complexity treatment	Implicit Industry Knowledge
1.4, 1.5, 1.7, 1.6	Transactional relationships	Structured Work Attributes	Mediated Knowledge Work
1.6, 3.4	Standard frameworks	Structured Work Attributes	Mediated Knowledge Work
3.2, 3.7	Occasional novelty	Structured Work Attributes	Mediated Knowledge Work
2.6	Routines	Structured Work Attributes	Mediated Knowledge Work
11.1, 11.2, 11.4, 11.7, 11.8	Imposed technology	Divergent User Experiences	Context Sensitive Technology
11.4, 16.1, 16.2, 16.7	Poor utilisation	System Constraints	Context Sensitive Technology
12.4, 13 (all)	Inefficient processes	System Constraints	Context Sensitive Technology
11.5, 11.8, 12.2, 12.5, 12.7, 12.8, 13.5, 16.5, 11.5, 16.3, 16.5	Non-integrated systems	System Constraints	Context Sensitive Technology
11.6	Inadequate design	System Constraints	Context Sensitive Technology
9.1, 9.2, 9.4, 9.5, 9.7, 9.8 (same for 10)	Communication technologies	Divergent User Experiences	Context Sensitive Technology
9.3, 9.6 (same for 10)	Accounting applications	Divergent User Experiences	Context Sensitive Technology
11.1, 11.2, 12.6, 12.2, 12.6, 12.8	Graphical presentation	System Requirements	Context Sensitive Technology
12.6, 11.2, 13.5, 16.8	Optimal device for the job	System Requirements	Context Sensitive Technology
12.4, 16.8, 11.6, 12.2, 12.6, 12.8	Personalisation	System Requirements	Context Sensitive Technology
3.6, 16.5	Cumbersome systems	Complexity sources	Implicit Industry Knowledge
16.6	Sophisticated technologies	Divergent User Experiences	Context Sensitive Technology
14.2, 15.3, 15.5, 15.6, 16.1, 16.4, 16.6	Locally resourced and supported	Local Managerial Engagement	Mixed Organisational Support
14.2, 14.1, 15.4, 16.2	Quality networks	Local Managerial Engagement	Mixed Organisational Support
8.1, 17.3	Excessive Administrative Overhead	Managerial Indifference from	Mixed Organisational Support

		overseas	
11.4, 16.4	Inadequate training	Managerial Indifference from overseas	Mixed Organisational Support
14.3, 14.4, 14.5, 14.6, 14.7, 16.4	Under resourced	Managerial Indifference from overseas	Mixed Organisational Support
17 (all)	Role recognition	Managerial Indifference from overseas	Mixed Organisational Support
10.4, 10.2	Word processing applications	Divergent User Experiences	Context Sensitive Technology
17 (all)	Unsympathetic	Managerial Indifference from overseas	Mixed Organisational Support
12.4	Inflexibility	System Constraints	Context Sensitive Technology

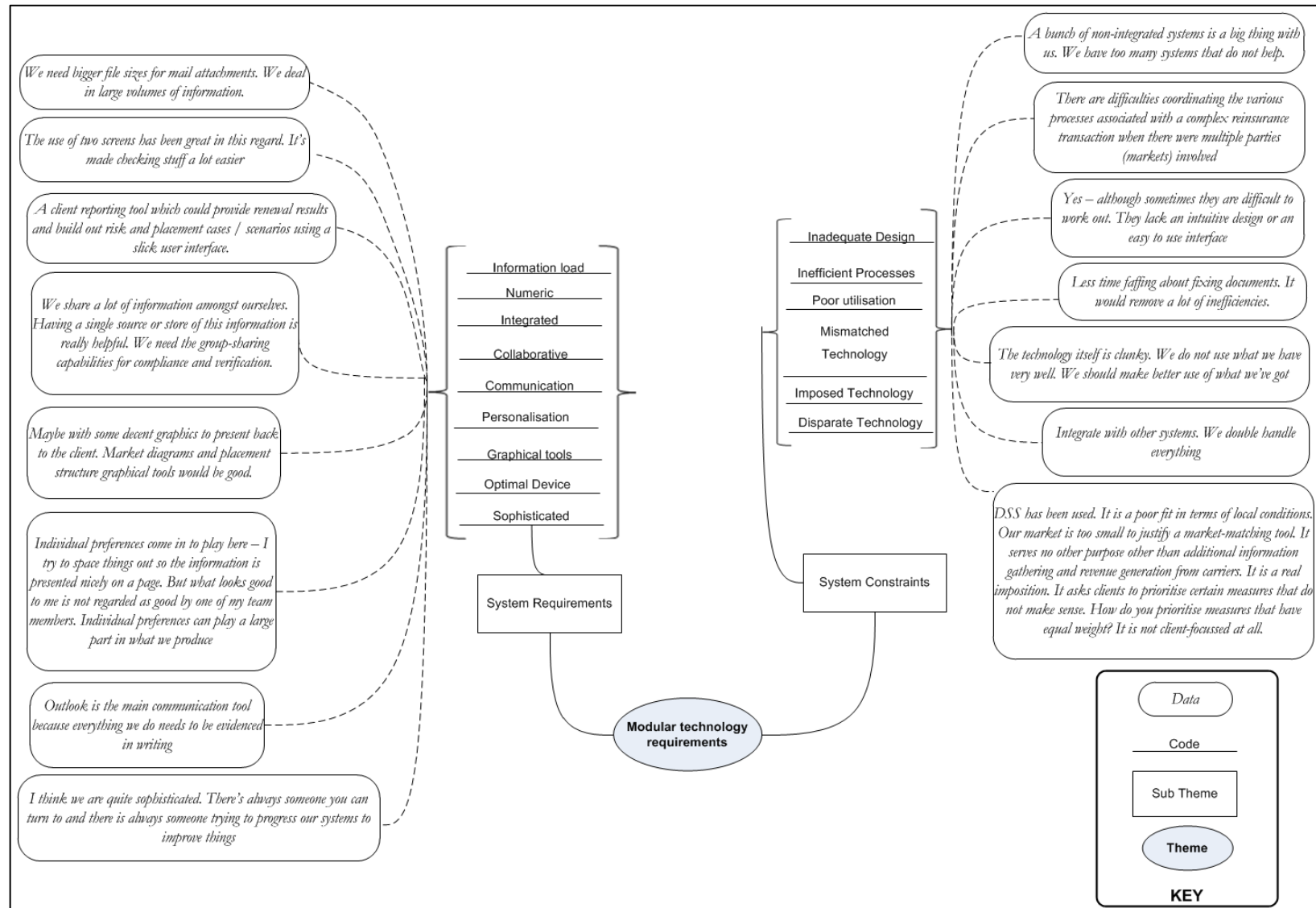
Appendix 5: Initial Thematic Mind Map – Mediated Knowledge Work



Appendix 6: Initial Thematic Mind Map – Implicit Industry Knowledge



Appendix 7: Initial Thematic Mind Map – Modular Technological Requirements



Appendix 8: Initial Thematic Mind Map – Mixed Organisational Support

