The Role of Intellectual Capital in Organisational Value Creation: An Application of a Theoretical Model to Two Case Studies

A Thesis Submitted for the Degree of Doctor of Philosophy

by

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Abstract

The research in this thesis focuses on the intangible resources of organisations. Intangible resources include an organisation's collective knowledge and learning, leadership talent, the values that shape its culture, routines and processes and the collaborative relationships. These intangible resources are known as intellectual capital (IC) because they support organisational activity along with financial and physical capital. Previous research has classified IC into three principle components of human, organisational and relationship capital and has established a link between IC and organisational value. Recent studies have also emphasised the notion of interrelationships between the three components of intellectual capital in developing capabilities that drive value creation. Yet it is often unclear how the various elements interrelate to one another to generate organisational value.

This thesis investigates *how* IC contributes to organisational value creation. Central to this research is the examination of the mechanisms through which IC factors are integrated within organisations in order to develop capabilities. As innovation is widely agreed to be a determinant of organisational value creation, this research adapted and extended the model of intelligence and innovation proposed by Glynn (1996) to develop a comprehensive theoretical framework for empirically examining the synergistic effects of IC. Building upon four major theoretical streams: resource-based view of the firm, innovation theory, intellectual capital theory and organisational capabilities, this research has elaborated the ideas and constructs presented in the original model and de-contextualised them to an intellectual capital perspective. A qualitative, interpretive approach was applied to two in-depth case studies for investigating the intangible resource-base of two knowledge intensive companies. The results were then expanded to a cross-case context in order to compare and contrast the value creating potential of the IC factors.

The findings of this research are presented in the form of a descriptive framework that classifies the characteristics of a value creating process. The purpose of the framework is to provide pointers for identifying IC resources and developing capabilities in a way that provides an organisation with sustainable competitive advantage, and thereby, value.

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Declaration

The following papers have been published as a direct result of this research.

Conference Papers:

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Dedication

To the memory of my father

Upali Abeywardena-Wickramasinghe

who has been a source of inspiration for me

Introduction

1.1 Introduction

The growth of knowledge-intensive organisations has highlighted that economic success is dependent less on traditional tangible resources and more on knowledge and its useful application. The pace of change, advanced technology, highly dispersed operations and the knowledge-intensity of goods and services have created a growing need for organisations to change their business models. Many of these changes involve the substitution of intangible assets for physical assets in order to adapt to the challenges and opportunities presented by the new knowledge economy. Within this knowledge economy the responsiveness necessary to compete is increasing and the challenge facing the organisations is to understand the intangible assets that drive competitive advantage and how these assets can be deployed.

Recently, several approaches have been proposed to define and measure a company's intangible assets, which are often described as intellectual capital (IC). Most of these definitions classify IC into three principle components of human, organisational and relationship capital. These three stocks interrelate and develop based on the exchange of knowledge between the individuals, the organisation and the customer. The classification helps to identify and clarify the nature of IC, but offers limited understanding of their complexities that drive value creation within organisations. Therefore, despite the recognised importance of intellectual capital, our understanding of how it contributes to organisational value creation is still underdeveloped. Furthermore, a review of the literature reveals that the complex and dynamic ways in which intellectual capital factors inter-relate and complement each other to generate value are not adequately addressed in the research literature.

In addressing this issue, this research *focuses on how intellectual capital contributes to organisational value and explores the interrelationships among the IC factors.* The next section

of this chapter introduces the background to the research problem, which describes the issues that motivated this research and explains why this problem is worth exploring. Section 1.3 sets out the aim and the objectives of this research, together with the research questions. Section 1.4 describes the methodology followed. Finally, section 1.5 presents an outline of the dissertation.

1.2 Background to the Research Problem

1.2.1 The Evolving Nature of Knowledge in Organisations

The recent economic change from an industrial society to a knowledge-based society has implications to organisations. Drucker (1993) asserts that organisations have passed through two phases of applying knowledge to wealth creation. In the first of these, knowledge was applied to tools, processes and products and created the industrial revolution. In the second phase, with the application of scientific management theories to production, knowledge was applied to human work, which ushered in the productivity revolution. Drucker (1993) argues that the emergent knowledge economy that is creating an economic revolution signifies the third phase, in which knowledge is being applied to knowledge itself and where economic value depends on the activities of knowledge workers. Knowledge work is characterised by variety and exception rather than the routine. Therefore, organisations require a new focus on the role that knowledge and meaning connected knowledge (understanding) play in the organisations' and individuals' ability to deliver quality work (Wiig, 1999).

Advances in information technology and the growth of computer networks have enabled the use of knowledge as a transforming agent (Stewart, 1997). This impact has changed the nature of the workplace where businesses are now involved in new realms of activity. Zuboff (1988) identified the dual role information technology plays in organisations. While the technology automates the manual processes, the same technology simultaneously generates information about the underlying productive and administrative processes, thereby providing a deeper level of insight. As a result of utilising this insight, the make up of today's products and the way in which they are delivered encapsulate an unprecedented amount of knowledge. Organisations are increasingly adding value to their products and services by more actively leveraging the know-how, experience and judgement resident within the organisation (Brooking 1999). Consequently, the growth of the many knowledge-based businesses that has fuelled economic growth has been identified as the reason for increased prominence of intellectual capital as a business and a research topic (Petty and Guthrie, 2000).

1.2.2 Knowledge as an Organisational Resource

An organisation's resources can conveniently be divided into three types: financial resources (e.g. equity capital, debt capital, retained earnings etc.); physical resources (e.g. plant and machinery, premises, inventory etc.); and intellectual resources (an organisation's knowledge, experience, routines and practices, leadership talent, relationships and market presence).

Traditionally, organisations have managed and reported the value of their financial and physical resources. Recently, however, research has shown that the real worth of these companies cannot be determined by accounting for only traditional resources. Research that compared the market value with the book value of 3,500 US companies over a 20 year period has shown that in 1978 a company's book value was typically 95% of market value, whereas by 1998 its book value was typically 28% of market value (Neely et al, 2003).

The additional value that is perceived by the market, but not recorded on the company's balance sheet reflects the value creating potential of the company's intangible assets. This means that investors are increasingly interested not only in the short term financial results (as denoted by the book values) but also in the drivers of long term success and value. This also implies that in the knowledge economy, a large proportion (e.g. over 70% as per the above research) of a company's assets are invisible because they are not accounted for and intangible because they are neither brick nor mortar nor inventory (Svieby, 1997). The investors assess the company's future potential based on intangibles such as the brand image, innovation potential, management practices and collaborative partnerships. Since the worth of companies in the knowledge economy lies in their knowledge resources, identifying and utilising these invisible and intangible resources become imperative.

The significance of knowledge resources is not restricted to the high technology sector, but is instead equally applicable to every organisation, both commercial and non-commercial. Moreover, the fundamental principles underlying knowledge resources are different from those applying to traditional resources, since knowledge does not behave like traditional resources. For instance, knowledge and ideas can replicate and multiply endlessly, whereas traditional resources deplete with use. Furthermore, knowledge resources are capable of multiple, simultaneous use and yield multiple, simultaneous benefits (Harrison and Sullivan, 2000). For example, a concert performance can be performed live to an audience, broadcast on radio and television and/or sold on CDs. Similarly, a software code can generate value through being packaged into products and/or sold as a licence. This multiplier effect of knowledge as a resource means that significantly different business models must be brought to bear than in the past.

The business and management practices in the industrial economy are no longer adequate to meet the dynamic conditions of the knowledge era. Therefore, organisations appear to be looking for new approaches to working, business structuring and accounting (Hand and Lev, 2003; Stewart, 1997; Sveiby, 1997). Hand and Lev (2003) assert that managers and financial analysts currently lack knowledge about the systematic findings of research into the economic attributes of intangibles. They argue that, as a result, the management of intangibles and the valuation of knowledge-intensive companies tend to be haphazard.

1.3 Research Aim and Objectives

1.3.1 Research Aim

The above discussions reveal that although there is much to support the assertion that intellectual capital is instrumental in the determination of organisational value and macro economic performance, there is a current lack of systematic research into the attributes of intellectual capital. In order to create value from intellectual capital, it is necessary to understand its dimensions as well as the interrelationships among them (Edvinsson and Malone, 1997; Eisenhardt and Martin, 2000). This rationale will be at the heart of the research presented in this thesis. As a result, the aim of this research is to:

Investigate how intellectual capital impacts on value creation within organisations. In doing so, resulting in the development of a framework for describing the core elements of IC and how they interact to create value.

1.3.2 Research Questions

The focus for the study has been framed in the form of three research questions:

RQ1: How does a particular enterprise create value?

RQ2: How do the different elements of IC contribute to that value creation?

RQ3: What characteristics of IC are common across different organisations?

1.3.3 Research Objectives

In response to the research questions posed above, a set of clear research objectives are stated as follows:

- Conduct a review and classification of the literature relating to knowledge resources, with a view to establishing the research focus.

- Assess the models and approaches that have been developed to identify, define and measure intellectual capital. In doing so, identify the issues associated with the deployment of these resources for organisational value creation.

- Identify an appropriate theoretical model, expand and de-contextualise where necessary to provide a novel and comprehensive framework for the empirical investigation of how intellectual capital contributes to organisational value creation.

- Carry out a field study to empirically examine the propositions that innovation within an organisation is a function of individual efforts and organisational mechanisms.

- Develop a descriptive framework from the insights gained from the cross-case comparison.

1.4 Research Methodology

The study entails the investigation of the role of individuals in creating innovations and the influencing factors such as the individual context, organisational context, enabling conditions and the external context. Uncovering the tacit, often hidden aspects of organisational life strongly suggests a mode of enquiry that would be interpretive and qualitative (Marshall and Rossman, 1999). The "how" questions posed by the study favour a case study approach as the questions deal with operational links needing to be traced over time, rather than mere incidence (Yin, 1994). Yin (1994) further suggests that the case study is preferred in examining contemporary events, but when the behaviours cannot be (or need not be) manipulated. In order to minimise the concern over the lack of rigour of the case study research and to report all evidence fairly, multiple sources of evidence such as direct observation, systematic as well as informal interviewing and documentary evidence would be used.

1.5 Dissertation Outline

The thesis is divided into eight chapters and follows the form as described by Phillips and Pugh (1994). Thus, the structure of the thesis consists of the four elements of background theory (chapter 2), focal theory (chapter 3), data theory (chapters 4, 5 and 6) and contribution (chapters 7 and 8). Chapter 1 has introduced the main issues that this research will address. The remainder of the thesis is outlined below:

Chapter Two: Literature Review – Background Theory

Chapter 2 begins by reviewing the impact of knowledge as an organisational resource. Following this is an examination of the nature and characteristics of knowledge resources. The

chapter draws upon four main theoretical streams - the resource-based theory of the firm, innovation theory, intellectual capital theory and organisational capabilities - to develop the foundation for examining the role of knowledge and the distinctive ways in which knowledge is integrated and organised by the organisation to generate value. The discussions identified the three key dimensions of IC that impact on organisational performance: human capital, organisational capital and relationship capital. The different dimensions imply different types of knowledge, but all are necessary for the dynamic organisation. A critical evaluation of the existing intellectual capital models revealed that because of the imperative to link IC with the stock market value, the models offered limited understanding of *how* the various IC factors created value for the organisations. The review of the literature also highlighted that the embryonic stage of research into IC offered the potential to contribute to the field by exploring the hypotheses already developed to investigate specific issues as they present at a firm level.

Chapter 3: The Development of a Theoretical Model for Examining the Role of Intellectual Capital – Focal Theory

To address the issues raised in chapter 2, this chapter presented and justified a theoretical model. As innovation is widely agreed to be a fundamental determinant of organisational value creation, the focus of this chapter is on IC factors in the context of innovation. This research utilised Glynn's (1996) theory of innovation as the reference framework to investigate the impact of intellectual capital on innovation. The chapter sets out five main advantages offered by the application of Glynn's (1996) model. Building on Glynn's (1996) view of innovation, the chapter provided additional theoretical justification and de-contextualised the ideas, constructs and relationships from a psychological perspective to an intellectual capital perspective to develop and extend the model further in preparation for the empirical investigation.

Chapter 4: Research Methodology – Data Theory

Chapter 4 describes the methodology followed in this research to investigate the issues raised in the preceding chapters. The chapter evaluates the merits of various investigative techniques and approaches with justification provided for the qualitative mode of enquiry and associated data collection and analysis techniques.

A dual-case design facilitated the selection of two deviant cases, where two types of innovative projects have been selected within two organisations. Study One (chapter 5) is based on new business creation whereas study Two (chapter 6) focuses on technology innovation, hence allowing the investigation in diverse settings. Furthermore, the project in study One reflects incremental innovation as the project was based on the existing service experience of the organisation. The project in study Two reflects radical innovation, as the technology was

entirely new to the organisation and the industry. Study One is in the low-technology property sector, whereas study Two is in the high-technology multimedia sector.

Chapters 5 and 6: Empirical Investigation – Data Theory

Chapters 5 and 6 present the context and detail the findings of the two case studies that have been selected to provide direct empirical examination of the theoretical model. The purpose of the two chapters was twofold. Firstly to examine the propositions from the theoretical model in relation to the empirical findings. Secondly, to explore the mechanisms by which IC factors contributed to value creation. In interpreting the data, the two chapters illustrate each construct of the theoretical model with a variety of examples within the two respective companies.

Chapter 7: Cross-case Analysis and a Framework for Value Creation – Contribution

This chapter presents the key characteristics of the findings derived from the two case studies on a comparative basis, in order to compare and contrast the value creating potential of the IC factors. The inferences drawn have been presented in the form of a framework for visualising intellectual capital that effect innovation. The framework represents two aspects of value creation. First it illustrates the specific elements of IC that impact on innovation. Second, it describes the interrelationships between the various elements of IC by outlining the integration mechanisms that developed organisational capabilities. Therefore, the applicability of the framework centres on its use as a set of key indicators that provide an overall picture of the current state of IC and value generation within an organisation or a project team.

Chapter 8: Conclusions – Contribution (with limitations and further research)

Chapter 8 presents the conclusions of this study. The chapter sets out the main findings and the contributions of this research. The potential areas for further research are discussed based on the limitations identified.

Literature Review

2.1 Introduction

The purpose of this chapter is to demonstrate the context of this research. The chapter presents a review of the literature related to knowledge and intellectual capital. The ensuing discussion is organised in the following structure. The discussion starts by reviewing the role of knowledge in organisations. This serves as an introduction to the knowledge perspective that holds a more synergistic, if not holistic, model of the organisation. Section 2.3 discusses the nature and characteristics of knowledge resources and highlights the challenges involved in using knowledge as an organisational resource. Section 2.4 discusses the resource-based view of knowledge and its relevance to organisational performance and value creation. Section 2.5 provides a brief background to the development of intellectual capital field in order to highlight the areas that need research attention. Section 2.6 then discusses the concept of intellectual capital, defining its many facets, with section 2.7 examining the different perspectives of value and the different approaches to value creation. Section 2.8 examines several established IC models in order to focus the research effort. Finally, section 2.9 presents an initial conceptualisation that serves to provide an orientation to this research and forms the basis for the more comprehensive theoretical model that will be developed in chapter 3.

2.2 The Role of Knowledge in Organisations

On reviewing the literature, this research identifies five main factors as explaining the increased importance of knowledge as a business and research topic. First, knowledge is an essential element in the rich complexity of organisational life (Bontis, 2001; Hand and Lev, 2003; Stewart, 1997; Sveiby, 1997). Second, the pace of global competition and technological change has made it necessary for organisations to address a range of decisions regarding the creation, development and maintenance of their knowledge resources and capabilities (Zack, 1999). Third, our understanding of organisational knowledge aids the management practices of

planning, learning and communicating, decision making, human resources and information processing in organisations (Mintzberg *et al*, 1998; Quinn, 1992: Senge, 1990). Fourth, the knowledge perspective recognises the rising importance of innovation as the principle determinant of competitiveness (Petty and Guthrie, 2000). Fifth, the emerging trend within many firms support the assertion that intellectual capital that the organisational knowledge creates, is instrumental in the determination of organisational value (Bontis, 1999). On a similar basis, the valuation ratios provide an indication of the importance of an organisation's knowledge resources (Grant, 1991). In view of this importance, the literature calls for systematic findings of research into IC (Hand and Lev, 2003; Petty and Guthrie, 2000). For this reason, the focus in this research is on how knowledge contributes to organisational value creation through innovation.

While knowledge is considered as residing in individuals, a large amount of knowledge is both produced and held collectively (Larson *et al*, 1998). Such knowledge is produced when people in an organisation work together in tightly knit groups and communities. Collaborative problem solving, conversations and teamwork generate a significant proportion of knowledge assets that exists within an organisation (O'Dell and Jackson, 1998). As a result of this interaction organisational knowledge comprises of the company's experiences and company-specific knowledge, including information about a company's culture, communications and decision-making style, as well as the detail of business processes (Stewart, 1997). Thus, organisational knowledge implies a systemic view (Ansoff, 1979) that sees the organisation as a complex interweaving of component parts, where the whole is greater than the sum of the parts. Rather than dividing the components in terms of conventional hierarchy and function, this view assumes that the whole will exhibit emergent characteristics that are not present if its constituent components are regarded separately. This advantage stems from the management's ability to consolidate organisation-wide technologies and skills into capabilities that empower the organisation (Prahalad and Hamel, 1990) to adapt quickly to changing opportunities.

Drucker (1993) argues that only the organisation can convert the specialised knowledge of the knowledge worker into performance. This convergence between individual and organisational capabilities will realise tangible business results in the form of reduced inventories, faster cycle times, increased customer satisfaction, greater productivity, market image, enterprise viability and employee, community and society relations. It follows then that utilisation of such knowledge can lead to higher levels of organisational effectiveness and value.

A study undertaken by the Gottilieb Duttweiler Foundation, a Swiss think-tank found that only 20% of the knowledge available to an organisation is actually used (Brooking, 1996). This

indicates that organisations have the capacity for greater efficiency, profit, growth and competitive edge (Brooking, 1996). This also indicates the problematic nature of knowledge as an organisational resource. Where intangible rather than tangible assets are the sources of value creation, this deficit represents a concern to management. For this reason, organisations face a continuous challenge to create value from their knowledge assets.

In order to utilise knowledge effectively as a resource it is first necessary to understand the nature and characteristics of knowledge in organisations. The following section discusses the multi-faceted nature of knowledge and highlights the problems involved in using knowledge as an organisational resource.

2.3 Nature and Characteristics of Knowledge Resources

Drawing on previous studies that have indicated the presence of many characteristics of knowledge resources (Boisot, 1998; Davenport and Prusak, 1998; Nonaka, 1994; Starbuck, 1992), this research has identified the key characteristics that impact on the performance and the competitiveness of organisations. This research has then classified the knowledge characteristics under three areas of focus: operational, philosophical and economic complexities, to develop Figure 2.1. These characteristics are, however, interrelated and therefore are not mutually exclusive. It is the contention of this research that identification of these characteristics is important in order to cope with the complexities and exploit the possibilities associated with the indeterminate nature of knowledge.

The lines of research on the characteristics of knowledge suggest that philosophical assumptions determine the nature of knowledge resources (Grant, 1996; Nonaka and Takeuchi, 1995: Polanyi, 1966; Spender, 1996). These philosophical complexities give rise to both operational and economic complexities associated with knowledge resources, which have critical implications for management. These complexities are illustrated in Figure 2.1 and discussed below. The inward arrows in Figure 2.1 indicate that the foundations of knowledge stem from the philosophical assumptions about the origin and nature of knowledge, while the outward arrows indicate the resulting operational and economic complexities. For instance, as discussed below, the tacit dimension of knowledge embodied in individuals and organisational practices means that it cannot be readily articulated and therefore is not easily imitated by competitors, providing the organisation with an economic advantage. The operational problem posed for management is that in the same way that imitation of the organisation's knowledge is difficult for competitors, the organisation itself may not understand it adequately to exploit it effectively.

Operational Complexities	Philosophical Complexities	Economic Complexities

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┌──────────────┐   ┌──────────┐ ┌──────────┐        ┌──────────────┐
│ Data,        │   │Knowledge │ │Knowledge │        │ Does not     │
│ information, │   │viewed as │ │viewed as │        │ comply       │
│ knowledge    │   │justified │ │ socially │        │ with scarcity│
│ continuum    │   │true      │ │constructed│       │ assumption   │
└──────────────┘   │belief    │ └──────────┘        └──────────────┘
                   └──────────┘
┌──────────────┐                                    ┌──────────────┐
│ Invisible –  │                                    │ Subject to   │
│ difficult to │                                    │ increasing   │
│ understand   │                                    │ returns      │
└──────────────┘                                    └──────────────┘
┌──────────────┐        ┌──────────────┐            ┌──────────────┐
│ Exists at    │        │  Knowledge   │            │ Remains with │
│ multiple     │        │  resources   │            │ the seller   │
│ (individual, │        └──────────────┘            └──────────────┘
│ group and    │
│ organisational)│                                  ┌──────────────┐
│ levels       │                                    │ Knowledge is │
└──────────────┘                                    │ a 'public'   │
┌──────────────┐        ┌──────────────┐            │ good         │
│ The need to  │        │The dichotomy │            └──────────────┘
│ combine with │        │between tacit │
│ other        │        │and explicit  │
│ resources    │        │knowledge     │
│ for value    │        └──────────────┘
│ creation     │
└──────────────┘
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Figure 2.1: Characteristics of Knowledge Resources

2.3.1 Philosophical Characteristics of Knowledge Resources

Commodity and Community Views of Knowledge

The recorded study of the nature of human knowledge dates back to the times of Plato and Aristotle. However the interest in modern times is credited to management thinkers such as Peter Drucker (1993), Alvin Toffler (1970, 1980) and the philosopher Michael Polanyi (1962, 1966). The recent literature provides two contrasting interpretations of the nature of knowledge. The first view is that, building on Plato, Nonaka (1991) defines knowledge as justified true belief. Underpinning this view, Krogh *et al* (2000) state "when somebody creates knowledge, he or she makes sense out of a new situation by holding justified beliefs and committing to them". Similarly, building on Socrates and Plato, Liebeskind (1996) defines knowledge as "information whose validity has been established through tests of proof". This interpretation views knowledge in traditional epistemological terms, relating it to the conscious act of creating meaning. The second view, in contrast, focuses on linking knowledge to experience and action. Emerging during the 1960's among social scientists such as Garfinkel, Glaser and Strauss, this more recent tradition argues that reality (and hence also knowledge) should be understood as socially constructed (Stenmark, 2001). Building on Polanyi (1962) and Wittgenstein (1953,

1995), Sveiby defines knowledge as a capacity to act (Sveiby, 1997). Sveiby (1997) argues that one's capacity to act is created continuously by a process of knowing, which cannot be separated from its context. This view is evident in the work of Spender (1996) defining knowledge as comprising of "theoretical statements whose meanings and practical implications depend on their use and on the framework in which they are deployed". According to this tradition knowledge can only be defined in practice, in the activities of and interactions among individuals.

The above two different approaches view knowledge as adopting a commodity versus a community theory of knowledge (Stenmark, 2001). Scarbrough (1999) describes the approaches as embracing a content versus a relational view of knowledge. The first emphasises the cognitive quality of knowledge and sees knowledge as a thing that can be substantiated. The second focuses on knowledge as embedded within patterns of social relations. The commodity view sees knowledge as coupled to the individual while the community view sees knowledge as related to context. Stenmark (2001) notes that the commodity theory suggests that knowledge can be separated from the knower and therefore can be deployed and transferred without loss of integrity across different contexts. Based on this approach, activities such as drilling, mining and harvesting are used to extract knowledge from its source (Stenmark, 2001). However, the more knowledge is coded and abstracted to facilitate transfer, the more difficult is the task to link knowledge to action within particular contexts (Scarbrough, 1999). Moreover, the discreteness and the potential for severance from the prevailing context as suggested by the commodity view of knowledge is frequently not characteristic of the skills of individuals within an organisation (Winter, 1998). Spender (1996) argues that the distinction between Platonist and Aristotelian notions of rationalism and empiricism is useful to explain that humans know in two ways: one based on the exercise of reason and the other based on experience. Thus, Spender (1996) argues for a pluralist epistemology and emphasises the need for managers and researchers to recognise the possibility of several different types of knowledge such as individual and social as well as explicit and implicit.

Tacit and explicit dimensions of knowledge

Among the many knowledge schemata presented in the knowledge management literature, the dichotomy between tacit and explicit knowledge (Nonaka, 1994) has advanced our understanding of organisational knowledge flow and transfer. Tacit knowledge refers to personal knowledge, which is internalised in people's minds, acquired through experience and shared in a direct way through rich modes of discourse, including analogies, stories and metaphors (Choo, 1998; Nonaka, 1994). Thus, tacit knowledge is the cognitive dimension that comprises beliefs, ideals, values and mental models that are deeply ingrained in people

(Stenmark, 2001). While this cognitive component is difficult to articulate, it shapes the perception of the individuals. Explicit knowledge on the other hand is knowledge that can be easily articulated and shared and is transmittable in formal and systematic language. Nonaka and Takeuchi (1995) suggest that organisational knowledge is created through cycles of combination, internalisation, socialisation and externalisation that transform knowledge between tacit and explicit forms. Polanyi (1962) argues that every aspect of knowledge accumulated over time has two complementary dimensions: the tacit and the explicit. The tacit dimension of knowledge, which cannot be easily articulated, defines and gives meaning to its complementary explicit dimension, a broader concept or skill that can be articulated (Polanyi, 1962). Thus, Polanyi (1966) used the phrase "we can know more than we can tell" to describe what he meant by tacit knowledge.

In a strict sense, tacit knowledge is inherently non-transferable. It would become explicit once it is transformed so that it could be transferred. However, the transfer of tacit knowledge depends on the credibility of the transferor because tacit knowledge rests in the transferor's deeper awareness of the meaning of communicable details (Polanyi, 1966). Since we can know more than we can tell, it follows that the explicated element is always less than what we tacitly know (Sveiby, 1997).

Although it is a generally accepted distinction, doubts have been cast over the tacit-explicit dichotomy introduced by Nonaka and Takeuchi (1995). Drawing on Polanyi (1966), Tsoukas suggests that "tacit knowledge is the necessary component of *all* knowledge" (Tsoukas, 1996). Therefore, attempts to split tacit and explicit knowledge into mutually exclusive categories would be misleading, as the two are inseparably related (Giaglis, 2002; Marshall and Brady, 2000; Tuoukas, 1996). Stenmark (2001) raises the question whether there is explicit knowledge in organisations. He argues that although routines, rules and procedures that are classified as explicit knowledge, play a vital role in the transfer and acquisition of knowledge, they do not constitute knowledge. They are merely information that needs to be reflected upon and interpreted. Information becomes knowledge once it is interpreted by individuals and knowledge becomes information once it is articulated (Stenmark, 2001). In a similar vein, the subtle difference between knowledge and information is pointed out by Leonard-Barton and Sensiper (1998) when they suggest that knowledge in an organisational context comprises of relevant actionable information that is partially based on experience.

"Tacitness" makes organisational knowledge a strategic asset because competitors are unable to understand and therefore imitate performance-critical knowledge. However, if tacit knowledge creates difficulties in transfer between firms, then this same characteristic poses a problem by

preventing the transfer of knowledge within the firm to leverage corporate best practices (Szulanski, 1996). In general, people from the same tradition and culture have more tacit knowledge in common than have people from different traditions (Stenmark, 2001). This may also be true for groups within the same profession or firm. Organisations need to maintain the tacit/explicit balance in such a way as to allow easy transfer of organisational knowledge within the firm and prevent transfer between firms.

2.3.2   Operational Characteristics of knowledge resources

Knowledge within organisations is found both inside employees' heads and in documents and processes. This explains the considerable confusion about the differences between data, information and knowledge. Knowledge is distinctly different from data (discrete, unstructured symbols) and information (a medium for explicit communication) (Sveiby, 1997). *This research adopts the definition by Davenport and Prusak (1998) who offer the following pragmatic description of knowledge in organisations.*

"Knowledge is a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms".

These characteristics make knowledge valuable and at the same time difficult to manage well.

Davenport and Prusak (1998) emphasise that data, information and knowledge are not interchangeable concepts and distinguish knowledge from information and information from data on the basis of value added processes. They posit that transformation from data to information occurs through contextualisation, categorisation, calculation, correction and condensation, while the transformation from information to knowledge happens through connection, comparison and conversation. Other authors, notably Thomas Stewart dismiss the notion of data to wisdom hierarchy as unhelpful on the grounds that one person's knowledge is another person's data (Stewart, 1997). The determining factor then, is the knowledge that the user brings into the situation. Choo (1998) argues that the result of using information is that it changes the individual's state of knowledge and the capacity to act. When the information is interpreted in the light of the user's previous knowledge and experience, it does not *become* knowledge, but alters the existing knowledge by changing the individual's knowledge state (Choo, 1998; Stenmark, 2001), which creates new knowledge and new possibilities to act.

As discussed in chapter 1, knowledge resources are invisible and intangible, which causes problems of interpretation and operation. Intangible assets have no physical existence but are still of value to the organisation. Typically, they cannot be valued accurately (Sveiby, 1997). As a consequence, managers run the risk of underestimating the value of knowledge resources and their contribution (Edvinsson and Malone, 1997). At the same time, the inability to define knowledge makes it a valuable resource that cannot be imitated by competitors (Collis and Montgomery, 1995).

Knowledge exists at multiple – individual, group and organisational – levels. Since people and their work behaviour are at the centre of organisational effectiveness, one important aspect of management is to understand the complexity of how individuals use their minds to conduct work (Wiig, 1999). It concerns what they must understand and how they must possess specific areas of knowledge to be effective. While an individual's knowledge is mobile, moving with the person, collective knowledge becomes embedded in the firm's routines, norms and culture through dialogue and interaction (Nonaka and Takeuchi, 1995).

Tsoukas (1996) argues that individuals not only draw upon their own factual knowledge, but they also draw upon the collective knowledge, thereby internalising the embedded understandings of the organisation. Similarly, transferring personal knowledge to structural intellectual capital through dialogue and interaction allows better leveraging and utilisation of knowledge and creates new knowledge (Nonaka and Takeuchi, 1995). Since collective knowledge is generated internally and remains in the firm, it gives rise to economic rents associated with the competitive advantage (Spender, 1996).

2.3.3   Economic Characteristics of knowledge resources

Knowledge-based resources behave in a way that differs considerably from the behaviour of traditional monetary and physical resources, which complicates its measurement and use. Literature identifies four main economic characteristics of knowledge that will have significant and far-reaching implications for organisations. First, the scarcity defying expansiveness is one of its most important and defining characteristics (Bontis, 1999). This means that knowledge, as a resource does not comply with the scarcity assumption. Unlike physical resources, knowledge resources do not diminish when they are used. For example, if one person reads a journal paper and gains knowledge from it, the information in the paper remains the same. Any number of people can use it again without depreciating its content. Thus, knowledge can be used without being destroyed in consumption. Furthermore, the users' interpretive capabilities (justified belief) determine the applicability of that knowledge (Spender, 1996), for example, on better decision making or faster responses to key issues. Here, new knowledge is also created (Nonaka

and Takeuchi, 1995) by the interaction between the tacit (e.g. the users' experience and action) and the explicit (e.g. the journal paper) knowledge.

Second, whereas traditional resources are subjected to diminishing returns in terms of rising costs or diminishing profits, knowledge-based resources are subject to increasing returns (Arthur, 1996). Increasing returns are "the tendency for that which is ahead to get further ahead and for that which is losing advantage to lose further advantage" (Arthur, 1996). Increasing returns arise because incremental production of knowledge assets such as software is relatively cheap. These assets have a low opportunity cost beyond the initial investment made to create them. For example, when producing software, a firm incurs large fixed costs. However, once produced, more of that software can be made at essentially zero marginal cost – the cost of copying it to a disc or emailing it. According to Arthur (1996), not only costs of knowledge assets fall as a company makes more of them, but the benefits of using them increase, as people have a strong incentive to buy brands with a high market share so as to be compatible with those using the product already. Hence, the value of knowledge increases because it is widely used. Thus, rapid and effective re-creation of knowledge can represent a substantial source of competitive advantage.

Third, unlike physical goods, knowledge does not disappear when it is sold, but remains with the seller so it can be sold to many buyers. For instance, when a knowledge service such as a training course is provided, the provider not only keeps the knowledge but will have learned something new from the process (Sveiby, 1997). Thus, the more knowledge is supplied and shared, the more valuable it becomes.

Fourth, knowledge is said to be a public good, whereas land, labour and capital are private goods (Spender, 1996), making it difficult to protect against expropriation or illegal imitation. Since knowledge assets can be used by many individuals at the same time, the illegal use of knowledge can be very difficult to detect (Liebeskind, 1996). For example, Liebeskind (1996) points out that in many instances producing valuable knowledge requires the input of personal knowledge from a number of individuals. In such a case one member of the team may have the incentive to expropriate that knowledge for personal gains.

The philosophical, operational and economic complexities associated with knowledge resources as discussed above have far-reaching implications for organisations. Thus, these complexities necessitate different strategies (e.g. development of capabilities), business models (e.g. co-operative and collaborative ways of operating) and industry structure (e.g. network relationships) if knowledge is to be effectively developed and exploited. The next section

discusses designing strategy around the most critically important resources and developing an organisation's resource base through the development of capabilities.

2.4 A Resource-based View of Knowledge and Organisational Performance

Prahalad and Hamel (1990) find that systematic persistence in profitability arises primarily from the firm specific assets. The theory that most directly addresses this issue is the resource-based view of the firm. Resource-based theory views the firm as a unique collection of resources and capabilities (Nelson and Winter, 1982; Penrose, 1959; Wernerfelt, 1984). This perspective focuses on the internal organisation of the firms. Since the resource-based view explicitly recognises the importance of intangibles such as organisational knowledge, it offers the theoretical underpinnings in exploring the interrelationships between various intangible factors. According to the resource-based theory, firms compete on the basis of unique resources that are difficult to imitate by competitors and non-substitutable by other resources (Barney, 1991). Penrose (1959) provides a seminal contribution to the resource-based theory and argues that 'it is the heterogeneity ... of the productive services available or potentially available from its resources that gives each firm its unique character' (1959: 75). Hence, a firm may achieve sustainable competitive advantage not because it has better resources, but the firm's distinctive competence involves making better use of its resources (Mahoney et al, 1992; Penrose, 1959). These assumptions suggest that firms can achieve sustainable competitive advantage by implementing novel value-creating strategies that cannot be easily duplicated by competing firms (Conner and Prahalad, 1996; Nelson, 1991).

As in much of the resource-based literature, *it is claimed in this research that the type of resources that are most likely to be heterogeneous and hence a source of value creation through sustainable competitive advantage are those that are intangible in nature.* Such firm specific and often tacit resources accumulate slowly over a period of time (Amit and Schoemaker, 1993; Dierickx and Cool, 1989). For example, tacit organisational knowledge or accumulated customer information cannot be easily replicated by competitors since they are deeply rooted in the organisation's history.

Although the resource-based view defines resources broadly to include tangible and intangible resources, people-based skills and organisational processes and capabilities, Grant (1991) argues that there is a key distinction between resources and capabilities. Resources are the inputs into the production processes and include tangibles such as materials, plant and equipment and intangibles such as reputation, internal processes, product quality and skills of individuals. Grant (1991) asserts that since few resources on their own, are productive, productive activity requires the co-operation and co-ordination of teams of resources. Organisations create

competitive advantage by assembling resources that work together to create organisational capabilities. Thus, while resources are the source of an organisation's capabilities, capabilities refer to an organisation's capacity to deploy resources, usually in combination, using organisational processes to attain a desired effect (Amit and Schoemaker, 1993; Grant, 1991). According to Grant (1991), developing capabilities is not simply a matter of combining resources, but involves complex patterns of co-ordination between people and other resources. Improving and perfecting such co-ordination requires learning through repetition (Grant, 1991). A firm's strategic direction dictates the way in which the firm balances its resources and capabilities with the requirement to create the products and services for the market, in a manner superior to its competitors (Zack, 1999).

Grant (1991) further argues that capabilities are rooted in the business practices and routines and that the amount and quality of resources available to a firm are important since they place constraints upon the range and the standard of organisational routines that can be performed. However, resources cannot be evaluated in isolation, because their value is determined in the interplay with market forces (Collis and Montgomery, 1995). Collis and Montgomery (1995) further argue that capabilities built up over time can transform otherwise pedestrian resources into superior products and services. It follows then, that an organisation is positioned to succeed if it has the most appropriate resources and capabilities to serve its markets.

Resource-based view explicitly acknowledges a firm's history as an antecedent to its current capabilities (Collis and Montgomery, 1995; Dierickx and Cool, 1989). Innovation is seen as based on the accumulation of firm-specific skills (Leonard-Barton, 1995; Pennings and Harianto, 1992). Thus, viewed from a resource-based perspective, innovation is a competitive capability that is not easily imitated or substituted. It is therefore a differentiating process in which firms attempt to establish market controls by developing new products and services. Thus, the pursuit of innovation is vital to achieving competitive advantage in dynamic industries (Eisenhardt and Martin, 2000). Innovation theory together with the creativity theory is discussed in detail in the next chapter (3).

The above discussions recognise that knowledge as an organisational resource has particular characteristics that require a unique analytical framework. The concept of intellectual capital provides such an analytical framework by providing a mechanism for identifying and measuring the intangible resources within the organisation. The following sections explore the concept of intellectual capital and discuss its different dimensions.

2.5 Intellectual Capital: A Brief Background

The discourse of intellectual capital in the management literature focuses on two different but overlapping themes of interest. One theme is external and is concerned with measuring and reporting of intangible resources to shareholders and other stakeholders (e.g. Brooking, 1996; Edvinsson and Malone, 1997; Kaplan and Norton, 1992; Roos *et al*, 1997; Sveiby, 1997). Here the interest is to illustrate the strengths of the firm through intellectual capital statements. These authors set out different approaches to assessing organisational knowledge. While these approaches are useful for accounting and external reporting purposes, they do not provide managers with a deeper understanding of the company's overall knowledge resources. The other theme is internal and is concerned with the development and management of knowledge (e.g. Andriessen, 2001; Bontis, 1998,1999,2001; Davenport and Prusak, 1997; Stewart, 1997). The interest here is related to improving the value of human, organisational and customer resources of the firm, making the firm a 'reservoir' of intellectual capital. Roos *et al* (1997) describe the two streams of thought as the measurement stream and strategic stream, as shown in Figure 2.2. The former focuses on constructing new reporting mechanisms for measuring non-financial, qualitative items of intellectual capital while the latter focuses on the way knowledge is created and leveraged into value. *As highlighted in Figure 2.2, the focus in this research is to investigate how intellectual capital impacts on organisational value creation through innovation.*
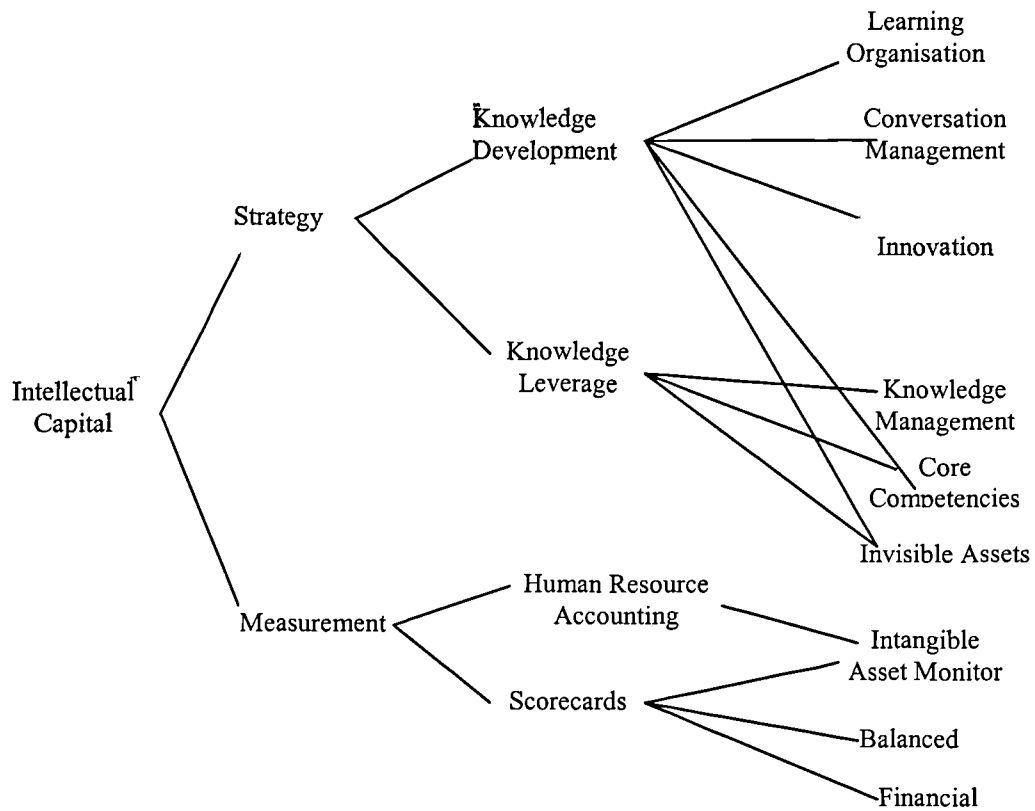
Figure 2.2: Model Representing the Research Routes on Intellectual Capital (with the route of this research highlighted)

(Source: Petty and Guthrie, 2000; Roos *et al*, 1997)

The literature related to intellectual capital research studies is limited. This is partly due to the embryonic stage the field is in (Bontis, 2001). Most research on intellectual capital to date has been based on case based reviews of knowledge management initiatives. Other researchers have documented the metrics that have been developed by the early pioneers of intellectual capital.

Several researchers have reported evidence of a positive relationship between an organisation's performance and its level of intellectual capital. Greenley (1995) showed a link between relational capital that can be leveraged from customers and company performance. The observations confirmed that a group of UK companies with a higher customer orientation achieved a higher return on investment than a group with lower customer orientation. In a pilot study using survey data on 64 companies in Canada, Bontis (1998) showed a strong and positive relationship between Likert-type measures of intellectual capital and business performance. The results showed that for organisations to effectively use their knowledge base there must be a constant interplay between human, structural and customer capital. This means that isolated

knowledge that resides in employees' minds does not affect business performance unless it is integrated with organisational structures. The 64 observations represented a variety of organisations in different industries. However, in this pilot study Bontis (1998) used MBA students as representatives of their respective companies, which might have affected the accuracy of data collected. Bontis (1998) calls for an improvement on this aspect by eliciting responses directly from the executives of companies. Using a case study in a telecommunications software company, Peppard and Rylander (2001) illustrate how the company dramatically increased shareholder value through proactively developing its intellectual capital. Peppard and Rylander (2001) conclude that by applying the intellectual capital perspective, the company was able to understand the value creating behaviour of the different intangible resources within the organisation.

Petty and Guthrie (2000) observe that the contribution of early studies helped to establish the importance of intellectual capital in creating and managing a sustainable competitive advantage. According to Petty and Guthrie (2000), research is now in the second stage of development where robust evidence is needed in support of the further development of intellectual capital. In line with this observation Hand and Lev (2003) call for more systematic findings of research into the economic attributes of intellectual capital. *In light of this, this research study contributes to the field by attempting to understand the underlying mechanisms of intellectual capital that contribute to organisational value creation.*

2.6 The Concept of Intellectual Capital

Intellectual capital is knowledge that can be converted into profit (Harrison and Sullivan, 2000). Some authors use the term to refer to the knowledge and knowing capability of a social collectivity such as an organisation (Nahapiet and Ghoshal, 1998). Stewart (1997) defines intellectual capital as the sum of everything everybody in a company knows that gives it a competitive edge. "Intellectual capital is collective brainpower. It is the knowledge of a workforce; the training and intuition of a team of chemists who discover a billion-dollar new drug or the know-how of workmen who come up with ways to improve the efficiency of a factory. It is the electronic network that transports information through a company. It is the collaboration - the shared learning - between a company and its customers, which forges a bond between them that brings the customer back again and again". It follows then that the value of intellectual capital is the extent to which these knowledge assets can be converted into financial returns for the organisation.

Often the term "intellectual capital" is identified as being synonymous with "intangible assets". Some definitions identify intellectual capital as a subset of the overall intangible asset base of an

organisation. This implies that there are items of an intangible nature that do not logically form part of an organisation's intellectual capital (Petty and Guthrie, 2000). Petty and Guthrie (2000) use the example of a firm's reputation as one such item. "Reputation may be a by-product (or a result) of the judicious use of a firm's intellectual capital, but it is not part of intellectual capital *per se* ".

Much of the research on intellectual capital has primarily evolved from a financial and accounting perspective (Bontis, 1998; Edvinsson and Malone, 1997; Roos *et al*, 1997; Stewart, 1997; Sveiby, 1997). These works attempt to analyse the enterprise's knowledge dimensions for two reasons: to understand what comprise of intellectual capital and to know what causes enterprises to be worth more than their book values (Bontis, 2001). Traditional accounting practice does not provide for the identification and measurement of an organisation's hidden values represented by intangible assets. Historically, traditional financial statements referred to intangible assets as "goodwill" which accounted for brands, trademarks and patents (ASB, 1997). In contrast, intellectual capital looks beyond to more indefinable assets such as the ability of a company to learn and adapt (Edvinsson and Malone, 1997).

Following the works of Bontis (1996,1998), Edvinsson and Malone (1997), Roos *et al* (1997), Stewart (1991,1994,1997) and Sveiby (1997) among others, the definition of intellectual capital has been refined to include a combination of human capital, organisational capital and relationship capital. This multi-dimensional conceptualisation helps to analyse organisational knowledge as intelligence found in employees, organisational routines and processes and the organisation's relationships with business partners and customers. The different dimensions imply different types of knowledge, but all are necessary to the dynamic organisation. *Following Hubert Saint-Onge (Chatzkel, 2000), this research asserts that intellectual capital represents the stocks of intangible assets, while knowledge is the electrical current that runs between these assets to grow the human organisational and customer capital.* According to Hubert Saint-Onge the growth of the intellectual capital determines the economic performance of the organisation (Chatzkel, 2000).

Human capital is the combined skills, knowledge and innovativeness of employees, necessary to solve customer problems (Edvinsson and Malone, 1997; Sveiby, 1997). Roos *et al* (1997) argue that employees generate intellectual capital through their competence, attitude and intellectual agility. Some of the key elements of human capital are know-how, expertise, tacit knowledge, problem-solving capability, creativity and entrepreneurial spirit (Nelson and Winter, 1982; Roos *et al*, 1997). Thus, human capital is a source of innovation and strategic renewal (Bontis, 1998). Bontis (1998) argues that the essence of human capital is the intelligence of the

individual. However, intelligence of the individual, by itself, is of little value to the organisation, as it needs to be combined with other forms of knowledge resources to create value. Human capital is the hardest of the three dimensions of IC to codify (Bontis, 1998) due to its tacit element. Roos *et al* (1997) argue that human capital is more than competence and requires motivation and direction or focus. Roos *et al* (1997) assert that this behavioural aspect of 'attitude' is a personality trait that can be improved by company efforts such as a positive environment and organisational learning. Learning both at the individual and organisational levels also improves the absorptive capacity (Cohen and Levinthal, 1990) of individuals, enabling them to recognise and value new external information and add it to their own knowledge base.

As companies grow and become dispersed and complex, it becomes difficult to gain access to the knowledge possessed by the human capital. At the same time, companies evolve over time to possess some form of collective intelligence (Bontis, 1998).

Organisational capital is concerned with the mechanisms and structures of the organisation that support employees in their quest for intellectual performance and therefore, overall business performance (Bontis, 1998). Thus, organisational capital comprises supporting structures and enabling conditions and provides the environment that encourages employees to create, leverage and embed knowledge within the organisation. This form of intellectual capital is totally proprietary and includes all the physical and non-physical manifestations such as routines and processes, databases, process manuals, strategic plans, culture and internal networks (Brooking, 1996). Culture embraces the organisational norms and management philosophies. Culture is of fundamental importance to organisational effectiveness since it provides organisational members with a shared set of values in which to interpret events (Roos *et al*, 1997).

Relationship capital is the long-term and stable relationships established by the company with its external stakeholders. The most important sources of relationship capital are customers, suppliers, business partners, shareholders and other stakeholders such as the local community (Sveiby, 1997). These relationships could be in the form of licensing agreements, partnering arrangements, financial relations, contracts and agreements about distribution channels.

None of the above three dimensions is complete in itself, but together they provide an integrated framework that will allow organisations design knowledge strategies. This research next discusses value creation and reviews some of the recent IC measurement models. Drawing from the existing models, this research then presents a conceptual model to illustrate the role that IC plays in the organisational value creation.

2.7 Organisational Value Creation

Intellectual capital is typically an intermediate good and needs to be combined and packaged into goods and services to yield value (Teece, 1998). According to the Oxford English dictionary, value is 'the ability of a thing to serve a purpose or cause an effect'. Value depends on the interplay between personal needs and the usefulness and cost of items that can satisfy those needs (Shillito and De Marle, 1992). On a similar note, Bowman and Ambrosini (2000) define value by distinguishing between 'use value' and 'exchange value'. Use value refers to the specific qualities of the product perceived by customers in relation to their needs (e.g. the acceleration and styling of a car). Exchange value refers to the price of the product. Because individuals have different needs, wants and desires that vary with time, organisations strive to create value along many dimensions such as economic, physical, emotional, social, cognitive and political dimensions (Nunamaker *et al*, 2001).

Value is created for the organisation when it provides goods and services to satisfy the needs and wants of customers (Shillito and De Marle, 1992). The value of a product increases in direct proportion to its advantages over competitive products and decreases in proportion to its disadvantages (Shillito and De Marle, 1992). It follows then that the value of any product is a function of its performance and price, relative to other products in the marketplace. Performance is measured in terms of the functions and features of the product as perceived by the consumer and price is the amount at which the product is sold.

While a consumer may express the value of products in terms of the benefits and costs, a seller would express the value in terms of the return (income less costs) from items sold. This return promotes economic value, which is determined by the net present value of a stream of future benefits that ownership of an item brings to its owner (Sullivan, 1998). Thus the market value of a company is determined by the recent profit history and future profit potential as denoted by the intangible assets of the company such as employee expertise, strong market position, brand name and research and development activity (Edvinsson and Malone, 1997). Thus, the essence of value is the prospect of benefits.

As the traditional industrial economy is being replaced by a knowledge-based economy, organisations create sustainable value through the creation of knowledge and know-how and its conversion into innovation with commercial value (Sullivan, 1998). Harrison and Sullivan (2000) propose a variety of practices that enable organisations to create value from their IC.

These include:

1. Profit generation from products or services or intellectual property rights through sale, licensing, royalties, joint venture income and strategic alliance income;

2. Strategic positioning through market share, innovation and technology leadership, standard setting and name recognition (branding, trademarks and reputation);

3. Acquiring the innovation of others;

4. Customer loyalty;

5. Cost reductions;

6. Improved productivity.

Pike and Roos (2000) argue that organisations generate value internally through:

1. The values and quality of the corporate governance;

2. Effectiveness of the deployed intellectual capital;

3. Effectiveness of the resulting activities, processes and operations that produce the output of the organisation;

4. Quality of compliance with regulatory standards;

2.8 Review of the Current Intellectual Capital Models

Thus far, this research has argued for the importance of IC to organisational value creation and discussed the many possibilities available to organisations to utilise IC for this purpose. In order to gauge how the present research may be focused, several existing models for intellectual capital have been reviewed. Four main models are selected that stand as exemplars of research in intellectual capital for discussion in this section. In the next sub-sections, this research first presents these four models in turn. A comparative analysis of the basic features of each model is then offered in Table 2.1.

2.8.1   Technology Broker

Corporate Goals

Intellectual Capital

| Market Assets | Human Centred Assets | Infrastructure Assets | Intellectual Property Assets |
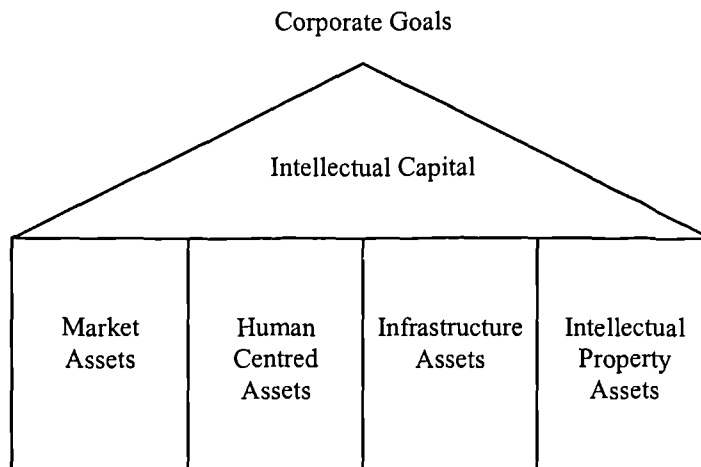
Figure 2.3: Technology Broker – The Components of IC (Source: Brooking, 1996)

Brooking (1996) defines IC as the combination of the four components of market assets, human centred assets, infrastructure assets and intellectual property assets. Market assets are those that give a company a competitive advantage in the marketplace. They include brands, market positioning, customer base, company name, distribution channels and so on. Human centred assets comprise the collective expertise, creative and problem solving capability, leadership, entrepreneurial and managerial skills embodied by the employees of the organisation. Infrastructure assets include a broad range of assets, which enable the organisation to function, such as management philosophy, culture, processes, methodologies and technologies. Finally, intellectual property assets include legally protected assets of the organisation such as patents, copyright, design rights, trade secrets and trade marks.

The Technology Broker model assesses the value of intellectual capital of a firm based on diagnostic analysis of the organisation's response to 20 questions covering the 4 IC components. The 'true' or 'false' response suggests that less an organisation is able to answer in the affirmative, the more focus it needs on strengthening its IC. The model then breaks down the 4 components into 34 lower level constructs. While it can be assumed that the 4 main components cover the total IC of an organisation, it is not clear if the 34 lower level constructs are complete and distinct. For example, the constructs for human centred assets are education, vocational qualifications, work-related knowledge, occupational assessments, psychometrics and work related competencies. The distinction between vocational qualification and work related knowledge is not clear-cut. However, the model offers a toolbox for organisations to identify, value and leverage IC in their organisations. The classification scheme and the lower

level constructs provide a useful starting point for this research in identifying the various elements of IC.

The model also defines the goals of the organisation and proposes that the value of IC is wholly dependent upon the goals of the organisation, which gives the context for valuation. The model offers three bases for valuing the intangible assets, which include the cost based, market based and income approach. Since the aim of this research is to understand how IC impacts on organisational value creation, the valuation methods of IC are beyond the scope of this research and therefore are not further explored.

2.8.2   Skandia Navigator
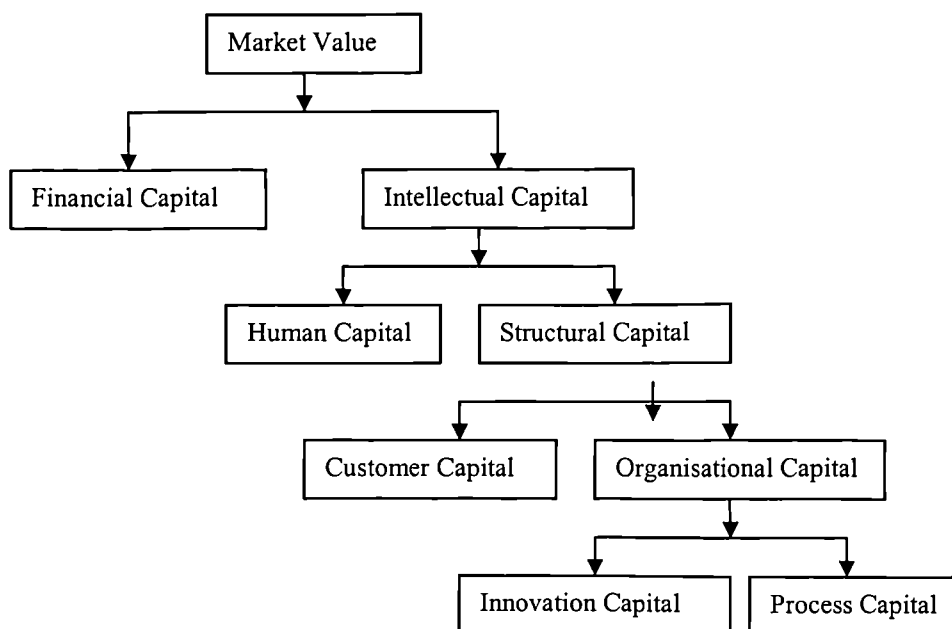
Figure 2.4: Skandia Navigator (Edvinsson and Malone, 1997)

Skandia Navigator is one of the earliest attempts at constructing a model for IC. The basic premise in this model is that the market value of an organisation is the sum of financial and intellectual capital. As shown in Figure 2.4, the model is hierarchical, with the IC branch expanded to show its constituent components. According to the model, human capital and structural capital comprise intellectual capital. The structural capital is broken down into sub-components as shown in Figure 2.4. The components are self-explanatory and therefore are not described here. Similar to the previous model, Skankia Navigator recognises the three main dimensions of IC as human, organisational and customer capital.

The model uses 111 main indices to measure the 5 areas of focus, of financial, human, customer, innovation and process. Edvinsson and Malone (1997) suggest the metrics are not intended to be a definitive set and that it is possible to choose a different set of attributes. The model follows a balance sheet approach to measuring IC and therefore, offers only a snapshot in time and cannot represent the dynamic flows among the various components. The model offers very specific indicators for each area of focus, designed to illuminate the driving forces for organisational value. However, the inclusion of computers etc. in structural capital as creators of value is questionable (Bontis, 2001). Edvinsson and Malone (1997) assert that the three dimensions of IC must be in alignment so as to complement each other. The potential to turn IC into corporate value, according to Edvinsson and Malone (1997) arises from the interaction among the three IC dimensions.

2.8.3   Intellectual Capital Index
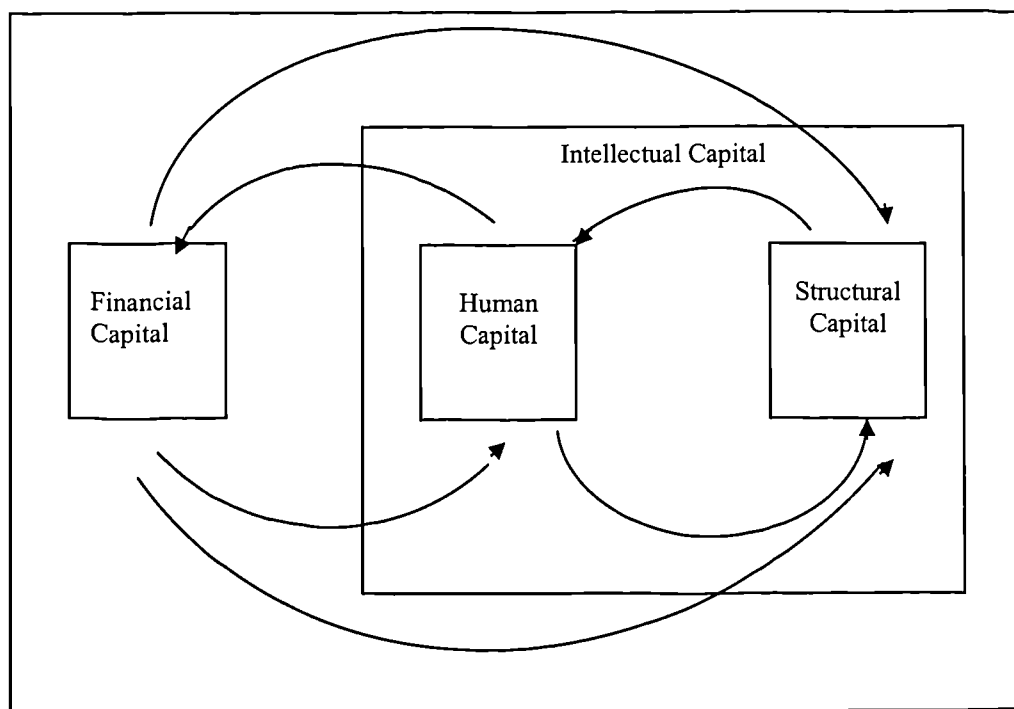
Figure 2.5: IC Index and the Internal Flows of Intellectual Capital (Roos *et al*, 1997)

The categories in the IC Index are based on the pioneering work of Skandia as discussed above. Therefore, the two models share a similar taxonomy as illustrated in Figure 2.4. Additionally, the model attempts to explain all the intangible resources and their flows, as shown in Figure 2.5. The IC Index and the flows that underlie it are based on a complete description of the

resources used by an organisation in the creation of value. The model proposes consolidating all the different intellectual capital measures into a single index. In this way, it is possible to provide a comprehensive picture of a firm's IC, which would allow both an inter-firm comparison and tracking of the relationship between the IC and the market value of an organisation.

2.8.4   Intangible Asset Monitor

Visible Assets	Intangible Assets (and sample measures)		
Tangible assets minus tangible liabilities	Competence of Personnel • **Growth/Renewal** (education, training, turnover) • **Efficiency** (proportion of professionals, leverage etc) • **Stability** (age, seniority etc)	Internal Structure • **Growth/Renewal** (investment in IT, contribution from customers to the internal structure etc) • **Efficiency** (values and attitudes, proportion of support staff etc) • **Stability** (age of the organisation, staff turnover, rookie ratio etc.)	External Structure • **Growth/Renewal** (organic growth, customer profitability etc) • **Efficiency** (customer satisfaction, customer-perceived quality etc) • **Stability** (customer loyalty, customer longevity, repeat orders etc)

Figure 2.6: Intangible Asset Monitor (Sveiby, 1997)

The Intangible Asset Monitor outlines a non-financial measurement system for IC based on the concept of knowledge organisation. The indicators of intangible assets are grouped into three main categories representing individual competence, internal structure and external structure. They broadly correspond to human, organisational and relationship capital respectively. Individual competence is the knowledge, skills, experience, value judgements and the social networks of employees. Internal structure comprises of the organisational structure such as the management, legal structure, R & D, software, routines and processes. The external structure includes brands, customer and supplier relations. The model employs the three families to describe the complete resources of the firm making up the intangible assets. In order to assess the intangible assets in each of the above three categories, the model identifies four critical measurement areas of growth, innovation, efficiency and stability that contain the individual indicators of IC. The choice of the indicators depends on the company's strategy. With the attributes selected, users define the measures and the monitor is formed by the measures taken.

Sveiby (1997) suggests that the model does not attempt to provide a full and comprehensive picture of a company's intangible assets, because such a system is not possible. In the Intangible Asset Monitor there is no real attempt to arrive at an estimate of market value. The purpose of the model, therefore, is to aid management in identifying and valuing the intangibles in their organisations.

2.8.5 A Summary of the Intellectual Capital Models

A common theme evident in the above models is that organisational performance is influenced by the organisation's intangible resources, which are embedded in the skills and experiences of its employees as well as in its processes and external relationships. All models offer a toolbox to identify and value IC in organisations. The main aim of the models appears to be to evaluate intangible assets for the purposes of external reporting in order to inform potential investors of the 'true' value of the firm. It also appears that the flows of knowledge resources between the different categories of capital are not explicitly modelled but are implicit in the indicators that are defined. For example, formal training of employees involves a flow of financial resources (cost of training) that can be captured. However, the consequent increased competence that resulted in more value-creating activities cannot be readily captured. Furthermore, all models fail to explain *how* the various aspects of IC combine to create organisational capabilities and value. Such an omission is perhaps an indication that *how* value is created from IC depends on the nature and activities of the organisation (Sullivan, 2000).

Based on the evaluation of the four IC models presented above, this research has summarised some of the basic features of the four models as shown in Table 2.1 below.

	Technology Broker	Skandia Navigator	IC Index	Intangible Asset Monitor
Originator Reference	Brooking (1996)	Edvinsson and Malone (1997)	Roos, Roos, Dragonetti and Edvinsson (1997)	Sveiby (1997)
Description of Intangible Assets	Human centred assets Infrastructure assets Market assets Intellectual property assets	Human capital Organisational capital Customer capital	Human capital Organisational capital Customer capital	Employee competence Internal structure External structure
Assumptions	The value of IC is organisation-specific as it is wholly dependent upon the goals of the organisation.	The market value of a firm is simply the sum of its financial and intellectual capital, the latter is considered to equate to the firm's intangible assets.	Similar to the Skandia Navigator, but additionally, the model considers the flows between different categories of IC.	There are four aspects of creating value from intangible resources: growth, innovation, efficiency and risk reduction.
Valuation Indicators	Cost approach Market approach Income approach	Financial focus Human focus Customer focus Process focus Innovation focus	Financial focus Human focus Customer focus Process focus Innovation focus	Growth Innovation Efficiency Stability
Strengths	The IC audit can be used for internal policy development. Can be used as internal feedback to organisational members to gauge the accomplishment of strategic goals. The classification scheme and the lower level constructs provide a useful starting point to this research in identifying the various elements of IC.	One of the first models to interpret and classify intangible assets. Addresses the assessment of all the knowledge assets of the company.	Consolidates all individual indicators of intangible resources into a single index. Changes in the index are then related to changes in the firm's market valuation.	The purpose of the model is not to present a full picture of the intangible assets, but rather to enable managers to measure operational efficiency through the use of non-financial indicators.
Weaknesses	The objective of the model is to quantify the economic value of the organisation's IC. However, the true financial value of intangible assets such	Mainly aims to evaluate intangible assets for the purposes of external reporting.	It is impossible to judge the overall IC of organisations.	The model assumes that by leveraging IC correctly, value creation will follow suit. For this to be true,

	as human capital and customer capital is difficult to ascertain. The emphasis is on describing and measuring IC rather than explaining how various aspects of IC combine to create capabilities and value.	The emphasis is on describing and measuring IC rather than explaining how various aspects of IC combine to create capabilities and value.	The emphasis is on describing and measuring IC rather than explaining how various aspects of IC combine to create capabilities and value.	managers must select IC factors that are crucial to value creation. The emphasis is on describing and measuring IC rather than explaining how various aspects of IC combine to create capabilities and value.

Table 2.1: Summary of the Intellectual Capital Models

2.9 An Initial Conceptual Model for Organisational Value Creation

The above IC models provide useful frameworks for clearly setting out the elements of IC that have a direct impact on value generation. The models provide managers with a meaningful overview of the organisation's intangible resources. However, there is little attempt to link these IC elements explicitly to value creation, since, in many cases, the imperative is to link IC with stock market value.

For this reason, this research utilises and adapts the main elements and terminology of the above models to present a conceptual model that illustrates the role that IC plays in the organisational value creation. *However, this basic model, as shown in Figure 2.7, only serves to provide an orientation to this research.* Similar to the above exemplary models, the conceptual model in this research distinguishes between different dimensions of IC and displays the dynamics among the three IC dimensions, highlighting the assumptions regarding the nature and the sources of knowledge required for the value creation process. Additionally, the model illustrates the nature of support provided by the organisational and relationship capital dimensions to the human capital to develop strategic capabilities such as innovation, technological and service superiority, customer responsiveness and brand management that drive value creation.

The model consists of five facets that contribute to organisational value creation, as follows: the three principle IC dimensions indicated as human, organisational and relationship capital, the collective organisational knowledge presented as intellectual capital and the strategic capabilities that drive value creation. Arrows indicate performance-influencing relationships. The model highlights that value creation primarily is an activity that involves an organisation's

human capital. Organisational capital supports the activities of human capital, while relationship capital enhances them. The model allows for describing all intangible resources at the organisation's disposal and how they interact to create value.

Organisational Capital
• Culture
• Management Philosophy
• IT infrastructure
• Routines and Processes

Supports

Human Capital
• Competence   Creates   Intellectual   Promotes   Strategic   Drives   Value
• Attitude   Capital   Capabilities
• Intellectual
  agility

Enhances

Relationship Capital
• Customers
• Alliances
• Stakeholders
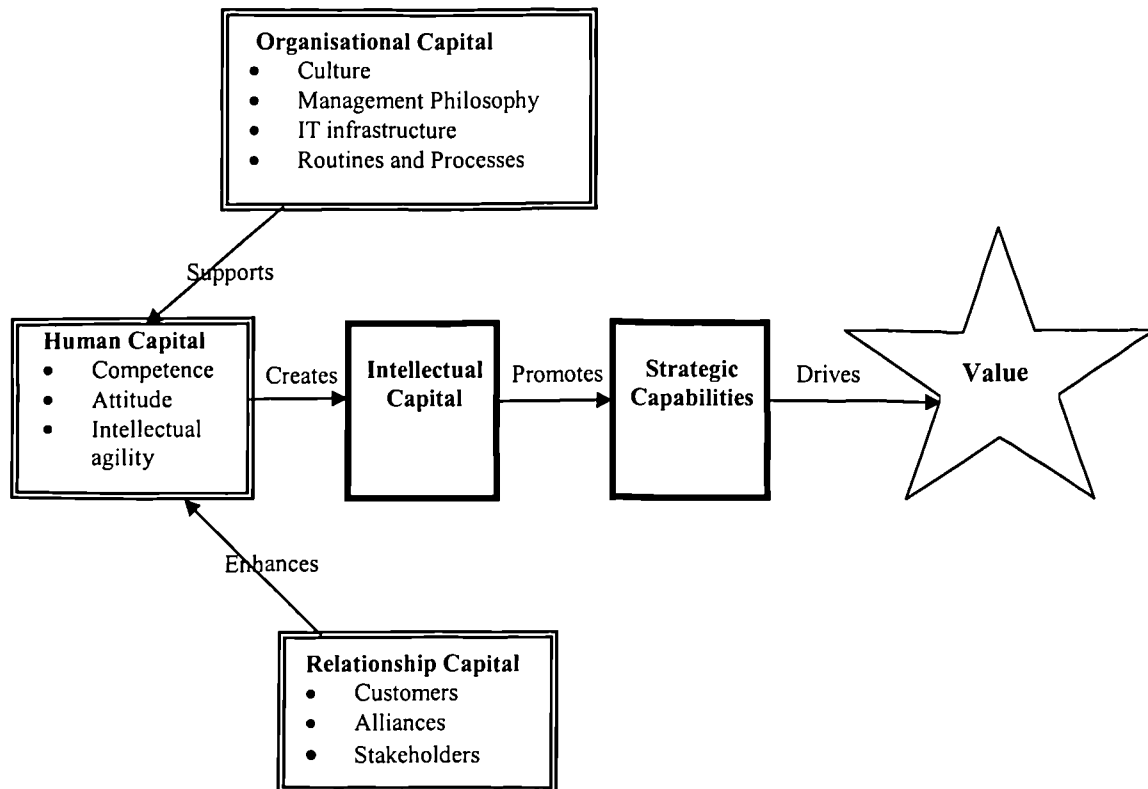
Figure 2.7: A Conceptual Model for Value Creation

Since this initial conceptual model is not in a format that can be operationalised, it will form the basis of a more comprehensive theoretical model that will be developed as part of this study in Chapter 3. Each dimension of intellectual capital will be expanded with detailed constructs and related propositions to facilitate the empirical examination.

2.10 Conclusions

Chapter 2 has provided a review of the literature on knowledge in organisations generally, and more specifically, on intellectual capital. The review presented evidence to highlight the role of a firm's intangible resources as the foundation for its competitive advantage. Thus, evidence suggests that organisations operating in environments of rapid technological change increasingly compete on the basis of their intellectual resources – their skills, knowledge,

experience and associated intangible resources – rather than the tangible monetary and physical resources.

Literature concludes the differences in characteristics between knowledge resources and traditional resources, which have far reaching implications for management. As identified in this research, these differences stem from the philosophical, operational and economic complexities associated with knowledge resources. These complexities necessitate different strategies, business models and industry structure if knowledge is to be effectively developed and exploited.

Adopting a resource-based perspective of the organisation, which links organisational performance to firm-specific resources and skills, it was argued that since resources can be easily duplicated by competitors, an organisation's only advantage may lie in the superior co-ordination of its resources to create organisational capabilities. This argument leads to the suggestion that value creation depends to a large extent on an organisation's ability to assemble, integrate and deploy unique, firm-specific resources. In reviewing the literature, it appears that the type of resources that are most likely to be unique, and hence a source of value creation are those that are intangible in nature. However, as discussed in section 2.2, research has found that managers may not understand intangible resources well enough to exploit it effectively. In addressing this issue, there is a clear need to understand the potential for intellectual capital in creating organisational value and competitive advantage. This research contributes to the intellectual capital field by attempting to understand the underlying mechanisms of IC that drive organisational value creation.

The analysis presented in this chapter identified the three key dimensions of IC that impact on organisational performance: human, organisational and relationship capital. An evaluation of the existing IC models revealed that because of the imperative to link IC to stock market value, the models offered limited understanding of how the various IC factors created value for the organisations. The main elements of these established models are utilised and adapted to present an initial conceptual model for organisational value creation. This model addresses an established void that is presented in this chapter. Since the model is not in a format that can be operationalised, it will be used as the basis for the more comprehensive theoretical model that will be developed in the next chapter (3).

Development and Operationalisation of the Theoretical Model

3.1 Introduction

The main aim of this chapter is to present a justification for the theoretical model used in this research. The model is selected as it provides a theoretical basis for examining the relations between the individual intellectual capital (IC) factors and organisational value creation. The chapter also provides a detailed review of the existent evidence on these relations. Discussions in Chapter 2 identified the three key dimensions of IC that impact on organisational performance: human capital, organisational capital and relationship capital. The different dimensions imply different types of knowledge but all are necessary to the dynamic organisation. Therefore, a search to identify how resources and skills impact on performance could yield insights into the nature of these intangible resources, how they develop and evolve in an organisation and how they can be leveraged to create value.

Evidence presented in Chapter 2 highlights two research issues: (a) that there is still limited understanding of the underlying mechanisms that link IC factors to organisational value creation and (b) the complex nature of the intelligence and creativity of the organisational members. With these issues in mind, this research applies innovation theory to explore how IC factors can be leveraged to create value in organisations. As stated in Chapter 2, innovation is widely agreed to be a fundamental determinant of organisational value creation (e.g. Drucker, 1993; Quinn, 1992; Sullivan, 1998). For this reason, the focus of this research is on IC factors in the context of innovation.

The theoretical model developed by Glynn (1996) on organisational innovation is a particularly useful model to explore the above issues as it provides a means for understanding the nature of intellectual capital factors in an innovative context. The relevance and applicability of this

model is discussed in detail in the following sections. The model proposes that innovation within organisations is a function of individual efforts and institutionalised processes to facilitate value creation. Such a model with well-delineated constructs predicts a pattern of relationships that can be explored in a real-life context (Miles and Huberman, 1994; Yin, 1991;) to identify resources and skills most strongly associated with innovative performance. It is hoped that an empirical examination of this theoretical model will help extend our understanding of the nature of intangible resources that impact on value creation.

Building on Glynn's (1996) view of innovation, this chapter provides additional theoretical justification to develop Glynn's (1996) model further in preparation for the empirical examination. Whereas Glynn (1996) draws on literature on psychology to explain and predict the factors that influence innovative performance, this research additionally draws on the literatures on intellectual capital and organisational strategy to further explore these factors.

This chapter is split into seven sub sections within two main parts - development and operationalisation - of the model. In the first part of the chapter, section 3.2 presents innovation as a context to examine intellectual capital factors. Section 3.3 examines the relevance and applicability of the theoretical model developed by Glynn (1996) to this empirical study. The section then extends the original model to better address an organisational context that incorporates collaborative business intelligence for creative solutions. Section 3.4 offers a review of the extended model.

In the second part of the chapter, section 3.5 discusses in detail the constructs leading to the propositions of the extended model. Section 3.6 discusses the operationalisation of the constructs. Section 3.7 concludes with a summary providing an overview of the chapter.

3.2 Innovation as a Context to Examine Intellectual Capital Factors

This research utilises Glynn's (1996) theory of innovation as the reference framework to examine intellectual capital factors. Glynn's (1996) model was developed based on organisational innovation, which is defined as 'the process of bringing new problem-solving ideas into use' (Amabile, 1988; Glynn, 1996; Kanter, 1983). This definition implies that innovation 'adds value'. This view is consistent with the suggestion by economists and business strategists that value creation is dependent on the exercise of specialist knowledge and competencies (e.g. Drucker, 1993; Prahalad and Hamel, 1990). In general, innovation is only regarded to have occurred if it has been implemented or commercialised in some way (Sullivan, 1998; Teece, 1998). Further, Tidd et al (2001) argue that definitions of innovation stress the need to complete the development and exploitation aspects of new knowledge, not just its

invention. Thus, innovative activity does not occur in isolation from the organisation's core activities, but involves the co-ordination of various creative, learning and implementation skills and structural resources.

Developing an innovative context requires an understanding of the nature of organisational knowledge and competencies (Hamel, 1994). While knowledge is grounded in the intelligence, experience, and expertise of individuals, organisations provide the physical, social and structural resources so that knowledge can be shaped into strategic assets that create value for the organisation.

Kimberly (1981) describes innovation as an attribute of organisations (i.e. innovativeness). Organisations that frequently cycle through the process of successful innovation are described as innovative. In the pursuit of examining IC factors, the focus in this research is not on innovation per se but on the context of innovation. Context refers to the internal and external realities of an organisation. Internal realities concern direction, resources and constrains while external realities concern the characteristics of the business environment within which the organisation operates (Sullivan, 1998).

3.3 The Relevance and Applicability of the Theoretical Model

It is known from past research that there are many intangible factors that influence innovation in organisations. For example, organisational orientation is important for creating a climate that encourages innovation (Gatignon and Xuereb, 1997). Similarly, the role of tacit knowledge has been identified as having an impact on innovative performance (Leonard-Barton and Sensiper, 1998). Nonaka and Takeuchi (1995) in their study of new product development programmes, describe the interplay between tacit and explicit knowledge as leading to the creation of new organisational knowledge. Pennings and Harianto (1992) examined the effects of inter-organisational collaboration on technological innovation. Johnson (2002) demonstrated from his study of technological innovation in collaborative R & D projects that enabling conditions that affect collaborative R & D projects are different from those in a single organisation. Johnson (2002) concludes that there is a need for greater awareness of the contexts in which various factors that enable technical knowledge creation are most effective. Studies conducted by Litman and Lohrmann (2002) found that understanding customer needs goes hand-in-hand with successful innovation. In their study of 199 banks, Bantel and Jackson (1989) found that innovation is positively associated with the level of cognitive resources (ie. high versus low cognitive skills, knowledge and ability) of a team as well as the diversity of views (functional backgrounds) represented. A wide range of other intangible factors has been suggested as important in the innovation process. These include personal attributes such as expertise and

creativity (Amabile, 1997; Csikszentmihalyi, 1996), cultural attributes such as trust, team work and management style (Anderson and West, 1994; Clegg *et al*, 2002) and task attributes such as complexity and control (Oldham and Cummings, 1996). Although these authors provide significant insights into the innovation process, these studies have focused on assessing the effect of one particular aspect on innovation. Thus, empirical support is lacking for the synergistic relationships among these intangible factors in an innovative context. The main purpose of this research is to present an integrated analysis of the effect of IC factors on innovative performance. A comprehensive model such as Glynn's (1996) will allow the synergistic influence of the key factors to be examined. Table 3.1 shows an illustrative selection of the main factors that impact on innovative performance.

A Selection of Factors that Influence Innovative Performance	Illustrative Empirical Studies
Level and diversity of cognitive skills	Bantel and Jackson, 1989
Tacit knowledge	Leonard-Barton and Sensiper, 1998
Interplay between tacit and explicit knowledge	Nonaka and Takeuchi, 1995
Creativity and expertise	Amabile, 1997; Csikszentmihalyi, 1996
Trust, teamwork and management style	Anderson and West, 1994; Cleg *et al*, 2002
Complexity and control of tasks	Oldham and Cummings, 1996
Inter-organisational collaboration	Pennings and Harianto, 1992
Customer intelligence	Litman and Lohrmann, 2002
Enabling and contextual conditions	Johnson, 2002
Organisational orientation	Gatignon and Xuereb, 1997

Table 3.1: A Selection of Factors that Influence Innovative Performance

Innovation theory as set out by Glynn (1996) elaborates the nature and function of intelligence in organisations and its role in affecting innovation. According to this theory, intelligence is embedded in organisations and operates through individuals and organisational systems to effect organisational innovation. The theory focuses on how intelligence is manifested by individuals as organisational members and by an organisation as a collective. Innovation theory outlines specific individual, social and contextual conditions that affect how intelligence is utilised within an organisation, providing a framework to understand the antecedents of organisational value creation. Based on this theory, both individual and organisational intelligence is strengthened or moderated by contextual factors. While Glynn's (1996) arguments were developed to explain the nature of individual and organisational intelligence and their impact on

innovation, these arguments are useful in understanding the nature of various intellectual capital factors in an innovative context.

The application of Glynn's (1996) model offers several advantages to this empirical study:

- Although not yet subjected to rigorous empirical validation (Bharadwaj and Menon, 2000), the model is theoretically derived and argued.

- The model offers a detailed elaboration of the logic underlying the theory.

- The model easily aligns this empirical study on the role of intellectual capital into the context of innovation, as discussed above in section 3.2.

- The basic assumption of the model is that an organisation's human capital, as represented by its individual and collective intelligence, constitutes a critical capability that needs to be supported by organisational systems for successful innovative performance. This view is consistent with the literature on intellectual capital (e.g. Stewart, 1997: Sveiby, 1997; Sullivan, 1998).

- The model is comprehensive in scope linking intelligence, creativity, personality factors and organisational contextual factors to innovation, and thus offers a useful means for examining the impact of the human and organisational capital attributes on innovative performance.

Figure 3.1 illustrates the original conceptual model as outlined by Glynn (1996) depicting the theory of innovation.
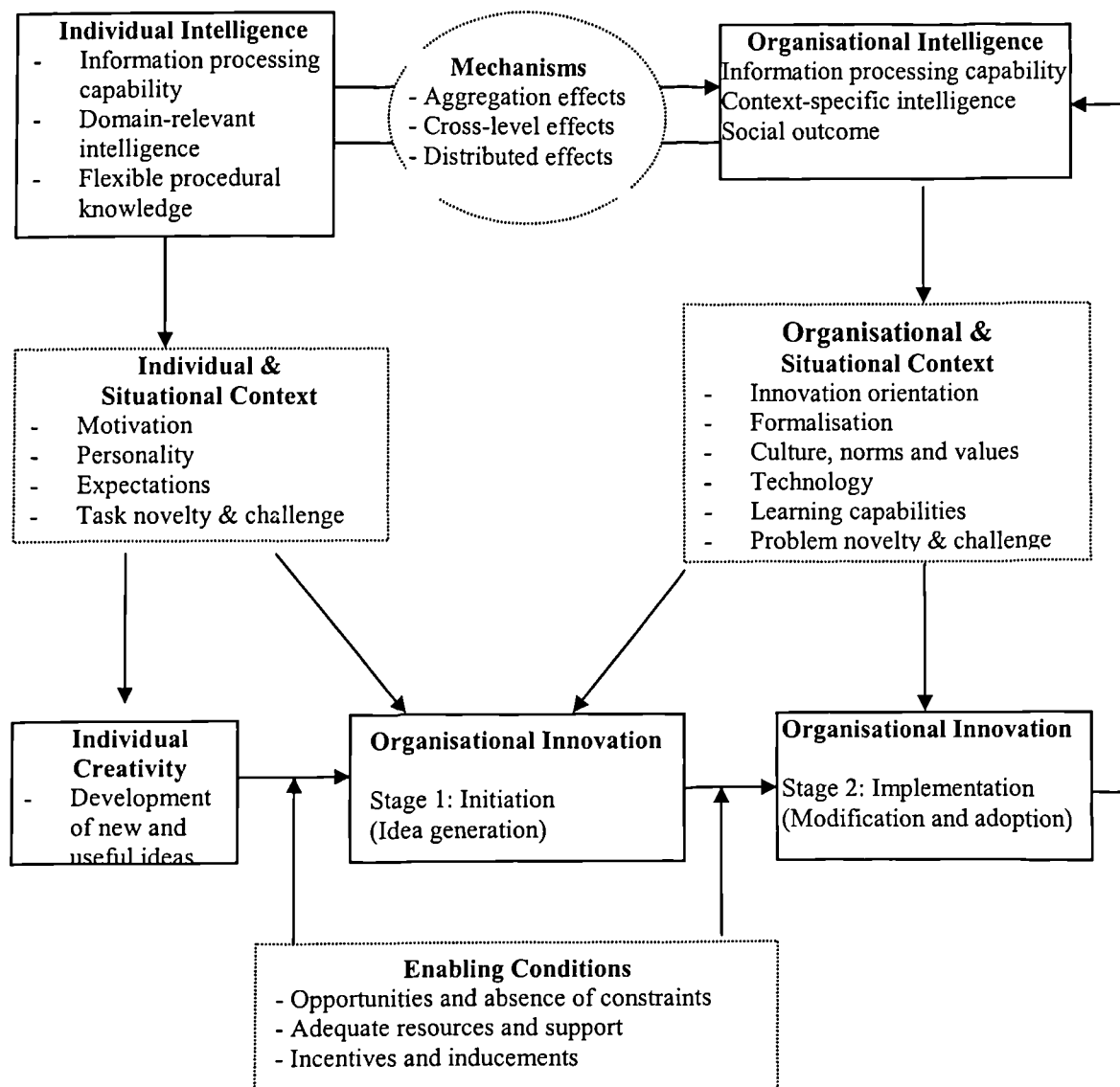
Figure 3.1: A model for Intelligence and Organisational Innovation (Source: Glynn, 1996)

A pivotal concept in the Glynn (1996) model is the intelligence and creativity of organisational members. This point of emphasis suggests that organising for innovation requires implementing co-ordination mechanisms that support the problem-solving efforts of the organisation's human capital. As was described in Chapter 2, human capital is the collective intelligence, skills, education, experiences and attitudes of an organisation's employees (Edvinsson and Malone, 1997; Sveiby, 1997). The co-ordinating mechanisms and the infrastructure that support the human capital are termed organisational capital in the intellectual capital literature (Edvinsson and Malone, 1997; Roos et al, 1997). Organisational capital encompasses the enabling conditions and situational factors as described by Glynn (1996) that are internal to a firm, such as a firm's culture, management philosophy, routines, systems and processes. Thus, Glynn's

(1996) theoretical model provides a means for examining the human capital and organisational capital factors that impact on innovation.

However, a possible weakness of Glynn's (1996) model is that it does not explain the impact of the external element of the intellectual capital dimension known as the relationship capital (Bontis, 2001; Edvinsson and Malone, 1997). The essence of relationship capital is the knowledge embedded in collaborative relationships external to the firm (Bontis, 2001) such as those with customers and alliance partners, which can lead to inter-firm co-operation over innovation. Collaborative business intelligence brings more perspectives and ideas to the organisation and therefore is a source of innovation and creativity. Moreover, innovation is creative problem solving, which makes customer problem identification through customer relationships a useful starting point (Dougherty, 1996) as it allows companies to fulfil customer needs in ways their competitors could not. This leads to the more rapid adoption of the idea in the marketplace. Since value is a function of how well a design meets the specific needs of consumers (Shillito and De Marle, 1992), high value-added depends on problem solving where insights are channelled to respond to the particular needs of customers. Hence this research suggests that activities of innovation extend beyond an organisation and are inextricably linked with the organisation's external environment (Teece, 1998). This research therefore extends Glynn's (1996) model to better represent an organisational context that incorporates the interactions with external stakeholders such as customers and alliance partners.

According to Glynn (1996) innovation is influenced by intelligence at two main levels of analysis: individual and organisational (collective). This research identifies a third level of analysis: collaborative business intelligence, as impacting on innovation. The former two levels of intelligence belong to the human capital of the organisation whereas the latter belongs to the relationship capital of the organisation.

Furthermore, since this research study is concerned with the innovative context and not with innovation per se, the focus of attention of this research is not on the individual stages of innovation, rather on the innovative process as a whole. Secondly, contrary to the popular view of breakthrough ideas and the creative genius, innovation is characterised by an iterative process of people working together building on the creative ideas of one another (Nonaka and Takeuchi, 1995). Thus, this research combines the two stages of innovation as set out in Glynn's (1996) model to further modify the model, as this level of specificity is beyond the scope of this research. All other constructs remain unchanged as per the original model.

Using the modified model of Glynn (1996) enables this study to address its three research questions (the reasons and the basis for the research questions were discussed in detail in Chapter 1) as follows:

(a) How does a particular enterprise create value?

(b) How do the different elements of intellectual capital contribute to that value creation?

(c) What characteristics of intellectual capital are common across different organisations?

The next section provides a review of Glynn's (1996) model as modified for the purposes of this research and describes the relationship between the major elements of the model.

3.4 A Review of the Modified Model

As described in the previous section, this research modifies Glynn's (1996) model of innovation in two respects as shown in figure 3.2. First, the original model is extended by introducing a third level of analysis of intelligence in the form of collaborative business intelligence to incorporate the external context of innovation. Second, individual stages of the innovation process are combined to provide one innovative context.

external context. The relationship and the interactions between the levels of intelligence as well as the contextual factors that impact on innovative performance are discussed below.

3.4.1. Intelligence at Three Levels of Analysis: Individual, Organisational and the Collaborative Business Intelligence

Cognitive psychology literature suggests that a complex and inexact concept such as intelligence is difficult to define precisely (Aiken, 1985). A considerable body of literature addresses intelligence from a variety of perspectives. Educators view intelligence as the ability to learn, biologists as the ability to adapt to the environment, psychologists as the ability to deduce relationships and computer scientists as the ability to process information (Aiken, 1985; Wechsler, 1975). Binet and Simon (1916) defined intelligence as the capacity to judge well, to reason well and to comprehend well. Sternberg (1981,1982) builds on this traditional definition and adds two other components: practical problem-solving ability and the ability to motivate oneself to accomplish tasks.

Glynn (1996) defines individual intelligence as a person's information processing capability, so as to apply knowledge to solve problems in a particular domain. The importance of experience and learning in determining intelligence has been emphasised by other psychologists (e.g. Wesman, 1968).

According to Glynn (1996) individual intelligence reflects a person's education, training, expertise and knowledge within a particular domain. It involves task-relevant domain intelligence (declarative knowledge) as well as flexible rules (procedural knowledge) that aid the development of new knowledge through combining existing (declarative) knowledge with new information. Procedural knowledge is known as "know-how" and concerns well-practised skills and routines whereas declarative knowledge is "know-what" and concerns the development of facts and propositions (Anderson, 1981; Nahapiet and Ghoshal, 1998; Ryle, 1949). Polanyi's (1966) distinction of the two aspects of knowledge: tacit and explicit, aligns with the "know-how" and "know-what" of Gilbert Ryle (Nahapiet and Ghoshal, 1998; Polanyi, 1966). It follows then that intelligence has both tacit and explicit dimensions.

Glynn (1996) refers to organisational intelligence as a higher order form of information processing capability. Organisational intelligence is also regarded as the collective and social outcome that the internal networks of relationships create. Another aspect of organisational intelligence is the shared representations, interpretations and systems of meaning among the organisational members that lead to context-specific knowledge. Organisations are influenced
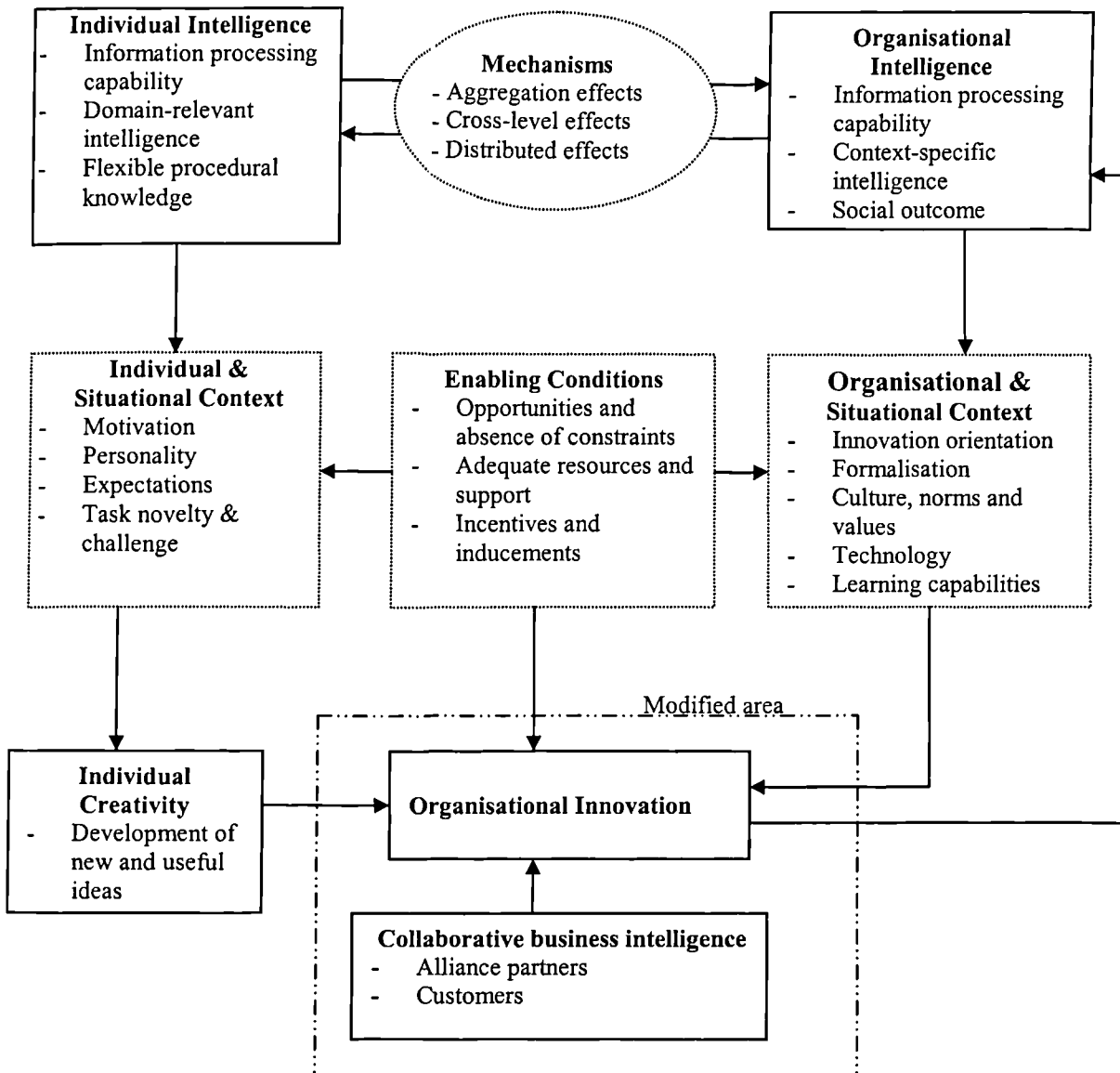
Figure 3.2: Modified Model of Intelligence and Organisational Innovation (Adapted from Glynn, 1996)

As indicated in figure 3.2 above, the model presents a theory on firm specific skills and innovation. The reasoning of the innovation theory begins with the assumption that an organisation's human capital as represented by the intelligence and creativity of its members constitutes a critical capability that needs to be nurtured for successful innovative performance. The model focuses on the role of individuals in creating innovations and examines influencing factors such as the individual context, organisational context, enabling conditions and the

by the aggregation of individual attributes, thoughts, feelings and behaviour (Staw and Sutton, 1992) which gives rise to the collective cognition.

Figure 3.2 illustrates three mechanisms that integrate individual intelligence with organisational intelligence. These mechanisms and their advantages and limitations are discussed in section 3.4.4.

While individual and organisational intelligence is internal to the organisation, a third and a vital form of intelligence that is external to the innovative organisation is collaborative business intelligence (Pennings and Harianto, 1992; Sveiby, 1997; Sullivan, 1998). This external intelligence is accessed through networking with firms in other industries to integrate strands of technology that is alien to the firm (Pennings and Harianto, 1992). According to Pennings and Harianto (1992), the ability to absorb external intelligence is facilitated by the firm's own accumulated intelligence. Learning that results from these external collaborative relationships feed into the organisational intelligence to enhance the organisational stock of skills. However, external intelligence raises issues of ownership, governance and sharing of costs, benefits and risks among the partners. The organisation needs to address these considerations when forming alliance partnerships. The accumulation and integration of intelligence residing both within and outside the organisation results in core competencies that are competitively unique (Hamel, 1994) and therefore create value for the organisation.

3.4.2. Individual Creativity and its Antecedents (situational context)

Firms innovate by developing and implementing the creative outcomes of its employees. Cummings and Oldham (1997) assert that employees exhibit creativity by developing new knowledge, advancing technologies or making process improvements. According to Amabile (1997) expertise, which contains the task-specific intelligence, is the foundation for all creative work. However, it is commonly acknowledged that intelligence is necessary but not sufficient for creative work (Aiken, 1985). Glynn's (1996) model identifies the individual characteristics and orientations including personality factors (Barron and Harrington, 1981) and intrinsic motivational factors (Amabile, 1997) as well as cognitive skills (Sternberg, 1988) that affect creativity. Individual creativity and its antecedents are discussed in detail in the next section.

3.4.3. Organisational Context and Enabling Conditions

Figure 3.2 illustrates the ways in which the work environment contributes to innovation. Glynn (1996) argues that individual creativity alone is not a sufficient condition for innovation. Individuals initiate innovative activities. However, it is the intelligent organisational systems that recognise and support viable innovation (Glynn, 1996). Specific factors that Glynn (1996)

identifies as contextual factors and enabling conditions support the creative process and lead to successful innovation. Amabile (1997) and her colleagues confirm this notion in a study where they found high statistical support for work environment stimulant factors. Amabile (1997) concludes that the conditions under which a person works can significantly affect the level of creativity produced. These internal factors are discussed in detail in the next section under the research model: constructs and propositions.

3.4.4. Mechanisms that Link Individual and Organisational Intelligence

Building on the assumptions that Walsh and Ungson (1991) used to develop the concept of organisational memory, Glynn (1996) describes three mechanisms by which individual intelligence is related to organisational intelligence – aggregation effects, cross-level effects and distributed effects. Table 3.2 sets out the theoretical assumptions and the advantages and limitations of each of these mechanisms.

Mechanisms	Theoretical Assumptions	Advantages	Limitations
Aggregation effect	Intelligence of individuals aggregates as organisational intelligence. Knowledge is not shared but held individually by organisational members. Organisational intelligence is considered as a function of its members. This implies that organisations with more intelligent members will be more intelligent.	A simplistic assessment of organisational intelligence as the aggregated total, the average or the maximum of individual intelligence.	Individual intelligence is not leveraged throughout the organisation through integration and sharing. Does not capture the variety of intelligence within an organisation. Knowledge is held in pockets of the organisation. Organisational knowledge disappears when individuals leave.
Cross-level effect	Individual intelligence is transferred and encoded in organisational systems to become organisational intelligence. Organisations with better diffusion and institutionalisation mechanisms will be more intelligent.	Effective use of structural, technological, social and/or political influence can enhance organisational intelligence.	The challenge of capturing and converting tacit knowledge into explicit knowledge Explicit knowledge is only a fraction of the total knowledge – 'the tip of the iceberg'.
Distributed effect	Organisational intelligence is embedded in the organisation's systems, routines, standard operating procedures, symbols, culture and language. These systems encode declarative and procedural knowledge that is complex, information-rich and context specific.	The ability to profit from collective learning and knowledge sharing. Knowledge and competencies are rooted in the company's history.	Difficulty in cultivating a sharing and trusting culture. Difficulty in creating an environment where people can communicate.

Table 3.2: The mechanisms that link individual intelligence with organisational intelligence (Sources: Glynn, 1996; Roos et al, 1997; Sveiby, 1997)

The aggregation effect represents organisational intelligence as consisting of the accumulated intelligence of its employees. Here, the organisational intelligence is viewed as the sum, the mean or the maximum value of employees' IQ scores on general cognitive ability (Glynn, 1996; Williams and Sternberg, 1988). However, this measurement does not capture the variety of intelligence within an organisation. Thus, the usefulness of this simplistic assumption is limited when the workforce is highly specialised, heterogeneously intelligent, loosely co-ordinated and geographically dispersed. Moreover, the synergetic effect (Ansoff, 1979) may mean that the

systemic intelligence is greater than the sum of the individual intelligence. The implicit assumption of the aggregation effect is that knowledge is not shared within the organisation, rather it is held individually by the organisational members. It is important to note that where there is no knowledge sharing, there is no knowledge creation because knowledge cannot grow when it resides in the minds of people in the organisation (Roos et al, 1997).

The cross-level effect is concerned with the transfer and institutionalisation of intelligence through technological (MIS and computer supports), structural (knowledge officer roles, communication systems) and social and political (social interactions, communities of practice, power and authority) mechanisms (Glynn, 1996). Accordingly, institutionalised processes convert and encode individual intelligence in the organisation's routines, procedures and memory and thus become organisational intelligence. Socialisation processes (Nonaka and Takeuchi, 1995) transmit intelligence from embedded systems to individuals. The assumption here is that knowledge sharing occurs when technology and policies co-exist within the organisation. Hence, the challenge for organisations is to convert tacit knowledge that is at the individual level into explicit knowledge at the organisational level, in order to aid collective reflection. However, as individuals can know more than they can tell (Polanyi, 1966), the explicit knowledge is only "the tip of the iceberg" (Sveiby, 1997).

In contrast to the cross-level effect, the distributed effect focuses on how the organisational intelligence is embedded in the patterns of thought, actions and interactions of members (Glynn, 1996). Thus, culture, interaction and socialisation processes distribute and encapsulate organisational intelligence. Here, the focus is on how individuals relate to each other and their organisation. In this setting, knowledge develops deep within the organisation over its history (Teece, 1998) and explains its competitive advantage as this type of collective knowledge is difficult to imitate by competitors (Nelson and Winter, 1982; Wernerfelt, 1989).

It is important to recognise that all three mechanisms co-exit in organisations to different extents. These mechanisms influence how core competencies (Prahalad and Hamel, 1990) develop and core rigidities (Leonard-Barton, 1995) settle in within the organisation. The challenge for management is to recognise the impact of each of these mechanisms, in order to develop programmes that can encourage desired practices to nurture a collective knowledge base and minimise the negative effects.

This section elaborated the ideas, constructs and relationships presented in the innovation model as illustrated in figure 3.2. The following section discusses the research model and the constructs that lead to the propositions used in this study.

3.5 The Research Model: Constructs and Propositions

The empirical study described in this research utilises a deductive approach basing the operationalisation of the constructs and related propositions as generated by Glynn (1996). The research model that is tested in this study is derived from constructs that are common to both innovation and intellectual capital theories. Glynn (1996) builds the propositions on five key constructs that impact on innovation: types of intelligence, levels of intelligence, creativity, enabling conditions and situational context. This research extends the original theory to include a sixth construct and a related proposition of collaborative relationships, providing a framework to understand the antecedents of organisational value creation in an innovative context. Figure 3.3 illustrates the expected relationships.

The research model as illustrated in figure 3.3 examines the link between the intellectual capital dimensions of human capital, organisational capital, relationship capital and innovative performance. The model consists of six key propositions and three sub-propositions that specify a number of constructs as impacting the innovative process and the relations among them. Propositions 1, 2 and 3 relate to human capital, while propositions 4 and 5 relate to organisational capital. Proposition 6 relates to relationship capital.

The propositions used in this research (with the exception of collaborative relationships) are the summarised version of the original propositions generated by Glynn (1996). Table 3.3 below shows the unabridged version of the original propositions as well as the summarised version as adapted for the purposes of this research, together with the new proposition (P6) added by the researcher.

Proposition Number as per the Original Model	Glynn's (1996) exact wording	Summarised version as used in this research
P1	Different dominant intelligences are associated with different stages of the innovation process. The dominant intelligence of innovation initiation (stage 1) is technical knowledge that is relevant to the task domain or problem. The dominant intelligence of innovation implementation and adoption (stage 2) is social, political and/or interpersonal, which is specific to the organisational context. Both stages are characterised by procedural flexibility in the combining and recombining of factual (declarative) knowledge.	*P1:There are two main types of intelligence that are associated with the innovation process. They are (a) technical knowledge that is relevant to the task or problem, and (b) social, political and interpersonal knowledge that is specific to the organisational context.* *Both types of knowledge are characterised by procedural knowledge (know-how) that enables the combination and recombination of declarative knowledge (know-what).*
P2	There are different dominant intelligences at different levels of analysis that affect the initiation stage of organisational innovation. The dominant individual intelligence is domain relevant, whereas the dominant organisational intelligence is context specific.	*P2:There are two main levels of intelligence that affect the innovation process. They are (a) individual intelligence that is domain specific and (b) organisational intelligence that is context specific.*
P3	Individual creativity is an antecedent of the initiation of organisational innovation.	*P3:Individual creativity is an antecedent of innovation.*
P4	The initiation, idea generation of organisational innovation is dependent upon individual creativity; creativity results in innovation under the following enabling conditions: when there is opportunity for creative expression and an absence of constraints, when there are adequate resources and support to develop ideas, and when there are strong intrinsic incentives.	*P4: Individual creativity results in innovation under four main enabling conditions: (a) when there is opportunity for creative expression (b) when there is an absence of constraints (c) when there are adequate resources and support to develop ideas and (d) when there are incentives that enhance intrinsic motivation.*
P5	Individual intelligence results in creativity when the dominant intelligence relates to the particular task domain (declarative knowledge) and when there is flexibility in combining rules for accessing and storing information (procedural knowledge).	*P3a: Individual creativity is influenced by two cognitive characteristics: (a) when there is task domain intelligence (declarative knowledge) and (b) when there is flexibility in combining rules (procedural knowledge).*
P6	Individual intelligence results in creativity when individuals have high intrinsic motivation and a personal orientation toward creativity.	*P3b: Individual creativity is influenced by two behavioural characteristics: when individuals have (a) a high intrinsic motivation and (b) personal orientation toward creativity.*
P7	Individual intelligence results in creativity when the task, problem or circumstances are novel, unfamiliar or heuristic and when an	*P3c: Individual creativity is influenced by two situational characteristics: (a) when the*

	intelligent approach to problem solving is expected and valued.	*problem is novel, unfamiliar or heuristic and (b) when an intelligent approach to problem solving is expected and valued.*
P8	Organisational intelligence results in innovation under conditions of high organisational orientation to innovation and when situational factors favour the expression of organisational intelligence, that is, when constraints are absent; the circumstances, problems, or tasks are novel, unfamiliar, or heuristic; adequate support and resources are available; an intelligent approach is expected and valued; and an organisation has a high capacity for effective learning.	*P5: Organisational innovation is influenced by two situational conditions: (a) high organisational orientation to innovation and (b) when situational factors favour the expression of innovation.*
Additional Proposition	-	*P6: Innovation is influenced by collaborative business intelligence in the form of: (a) collaborative relationships with business partners and (b) collaborative relationships with customers.*

Table 3.3: Propositions – Original and the Summarised version

Each of the key constructs included in these propositions will be examined to explain how and why they are operationalised in this study. In order to avoid duplication and redundancy, Glynn's (1996) theoretical justifications are not reproduced in this chapter. Thus, evidence provided in support of these constructs and propositions are in the main, in addition to what has been provided in the original paper. Furthermore, the constructs have been re-framed in terms of the constructs in the Intellectual Capital literature. In testing the propositions, it is not the intention of this research to examine a complete model of innovation, but rather to examine the role of intellectual capital in the context of innovation.

The propositions, sub propositions and their key constructs are illustrated in Figure 3.3. The propositions are categorised within the three dimensions of intellectual capital.
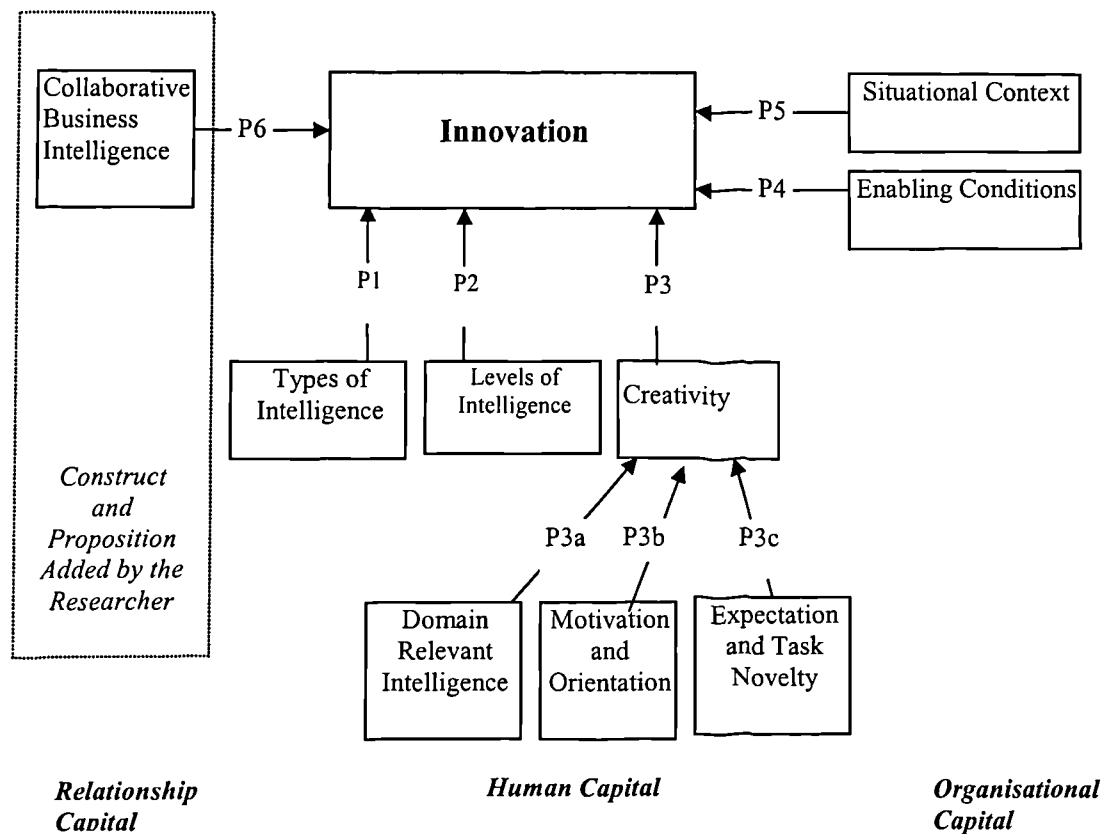
Figure 3.3: The Research Model: Constructs and Propositions

The following sub-sections discuss each construct and summarise the related propositions of the model. Operationalisation of each construct is discussed in section 3.6.

3.5.1 Types of Intelligence (Differing forms of expertise)

Glynn (1996) argues that different types of intelligence or different types of people are associated with the innovative process. Intelligence enables individuals learn from their own and others' experience, which aids the development of knowledge (Glynn et al, 1994). Such intelligence in organisations leads to a variety of skills, values and knowledge bases and provides enormous opportunity for innovativeness (Leonard-Barton, 1995). Several authors categorise intelligence that impact on innovative performance into two main types: domain specific intelligence and social or interpersonal intelligence. Domain specific intelligence is generally related to the level of education and training and determines a person's expertise in the domain. Social knowledge determines a person's level of influence and inter-personal skills.

Leonard-Barton (1995) for instance, distinguishes between highly skilled users who have domain-specific knowledge and implementers who have the political influence and 'authority' for the new technical developments. These two types of expertise essentially involve the creation and channelling of knowledge (Leonard-Barton, 1995).

Following Kirton (1976), Glynn (1996) argues that the two main types of intelligence that are associated with the innovative process are the intelligence relating to the domain specific technical knowledge and context specific social and political knowledge. Since the two different kinds of knowledge do not always come in the same human package (Leonard-Barton, 1995), different individuals are associated with a particular set of skills or expertise. The two types of individuals are idea generators who have the technical knowledge of the task domain and innovation champions who have the social, political or interpersonal knowledge that can influence the acceptance of the innovative change (Glynn, 1996).

Glynn's (1996) analysis of the two types of knowledge found support in the findings by Cummings and Oldham (1997) who distinguish between innovators and adaptors and suggest that innovators produce more creative outcomes than adaptors. These two intelligence types bring about different organisational outcomes and can compensate for each other's drawbacks. According to Sternberg et al (1997), creativity has shown to be domain specific since people are not creative in every field, but rather in specific areas.

Glynn (1996) posits that, for both types of knowledge, procedural knowledge (know-how) to combine and recombine existing factual knowledge (know-what) in new and different ways is critical. Vera-Munoz et al (2001) suggest that procedural knowledge may improve innovative performance because task-specific analytical skills (know-how) can identify better solutions. As discussed in chapter 2, procedural knowledge is mainly tacit and therefore verbally and often conceptually inexpressible (Polanyi, 1966), but plays an important role in knowledge work (Sveiby, 1997).

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 1: *There are two main types of intelligence that are associated with the innovation process. They are (a) technical knowledge that is relevant to the task or problem, and (b) social, political and interpersonal knowledge that is specific to the organisational context.*

Both types of knowledge are characterised by procedural knowledge (know-how) that enables the combination and recombination of declarative knowledge (know-what).

3.5.2 Levels of intelligence

Consistent with Glynn (1996), many research studies have identified that innovative performance is based on two main levels of knowledge within organisations: the individual intelligence and the collective organisational intelligence. Leonard-Barton and Sensiper (1998) argue that innovation depends upon the individual and collective expertise of employees. According to Drazin *et al* (1999) organisational creativity results not only from activities of single individuals but from dynamic processes of sense making within organisations. Organisational intelligence is context specific (Glynn, 1996) and is different from the aggregation of individual intelligence (Nahapiet and Ghoshal, 1998). Brown and Duguid's (1991) study of communities of practice showed that shared learning is embedded in complex, collaborative social practices. Similarly, the findings of Weick and Roberts (1993) support the idea that collective knowledge exists at the organisational level. In a study of information professionals, Lee *et al* (1995) found that intelligence has two meanings. It refers to characteristics and skills of professionals in the performance of their work. It also refers to organisational intelligence as a higher order form of information processing.

Individual intelligence becomes an organisational level construct when it involves social construction and becomes collective (Daft and Weick, 1984). Collective, organisational intelligence overcomes the limitations of individual members in their capacity to process information (March and Simon, 1958) leading to smart organisations (Glynn, 1996). Moreover, organisational intelligence is a key component of organisational learning (Huber, 1991), which has a significant effect on the growth and changes to knowledge in organisations (Duncan and Weiss, 1979).

It is widely recognised that, in order to achieve organisational productivity, individual knowledge needs to be enacted within a vision of the whole (Mintzberg *et al*, 1998). Thus, to be innovative, organisationwide skills need to be consolidated, together with a shared understanding of customer needs. Amabile (1997) proposes that creativity is enhanced when the entire organisation supports it. For this purpose, organisations must involve many levels of people and all functions in order to incorporate the organisation's competencies into their innovations (Prahalad and Hamel, 1990). In this setting innovation involves the simultaneous adaptation of the organisation (Leonard-Barton, 1988), enabling the stimulation and diffusion of innovative capacity throughout the organisation. Pelz and Andrews (1966) characterises innovation as 'tensions' because the innovation process involves combining insights, working between diverse activities and resolving the conflicting views of opposing forces. The need to

accommodate these tensions emphasise the communicative and interactive nature of the innovation process (Dougherty, 1996).

Bantel and Jackson (1989) examined the relationship between innovation and team composition with respect to age, tenure, educational background and functional background. They found that innovation was greater in banks headed by teams with heterogeneity in relation to age, education and functional experience. Their results suggest that both intellectual resource level and diversity are important for innovation.

The embedded interactions of individuals influence the development of context specific organisational knowledge that encompasses organisational culture (Walsh and Ungson, 1991), core competencies (Prahalad and Hamel, 1990), management styles (Sveiby, 1997) and routines and processes (Davenport et al, 1996), which are forms of intellectual capital that is totally proprietary. This form of organisational knowledge is largely tacit and hence hard to imitate by competitors. For example, the speed with which an organisation can bring innovative products and services to market may depend upon the intangible ability of the organisation to leverage the competence of its members.

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 2: There are two main levels of intelligence that affect the innovation process. They are (a) individual intelligence that is domain specific and (b) organisational intelligence that is context specific.

3.5.3 Creativity as an antecedent of innovation

Although creativity has been defined in a variety of ways, a core aspect of most definitions is that creativity involves a degree of novelty or deviation from standard practice (Amabile, 1988; Ford, 1996; Oldham and Cummings, 1996). Amabile (1997) argues that creativity is the first step in innovation. Creativity is defined as the production of novel and appropriate ideas by an individual or a group of individuals working together (Amabile, 1997). Thus creativity results in activities undertaken by individuals to enhance innovative business growth.

Glynn (1996) argues that organisational innovation is influenced by the extent of the creativity skills held by its members. Employees exhibit creativity when they develop a product, service or process that is both novel and useful to the organisation (Cummings and Oldham, 1997). Contributions are novel when they are unique or original relative to the organisation's existing repertoire of products, services and processes. Cummings and Oldham (1997) suggest that in

order to be a source of innovation, creative contributions must be directly relevant to the goals of the organisation and must enable the firm to extract value out of them.

Ford (1996) suggests that a journey leading to innovation incorporates several creative steps along the way. Ford (1996) argues that creative acts are the fundamental aspects that distinguish innovations from more routine efforts. Ford (1996) further elaborates that creativity plays a role throughout the innovative process, not just at the initial idea generation stage. For instance creativity may contribute to the design phase, but it also may help to overcome idiosyncratic problems that arise during the adoption process.

The preceding discussion suggests that innovative performance is enhanced when the creative skills of employees are improved. Therefore, Glynn's (1996) proposition is stated as:

Proposition 3: Individual creativity is an antecedent of innovation.

3.5.4 Antecedents of Creativity

Individual creativity has long been associated with intelligence (Gardner, 1993). However, it is commonly acknowledged that intelligence is necessary but not sufficient for creative work (Aiken, 1985; Glynn, 1996). Creative performance appears to be more a matter of motivation or special abilities than of general mental ability (MacKinnon, 1962). Consistent with these notions, Amabile (1997) posits that three main components at the individual or small team level are necessary for creativity. They are expertise, creative-thinking skill and intrinsic task motivation, as depicted by the three circles in figure 3.4. Furthermore, the level of creativity is related to the level of each of the three components. These creativity-skills can be developed through formal and informal mechanisms such as training, education and personal sense of challenge (Amabile, 1997).

Building on Amabile's (1988) componential theory of individual creativity as above, Glynn (1996) argues that individual creativity is likely to be determined by a complex interaction between three sets of factors. These are cognitive and behavioural characteristics of the individual and situational characteristics of the organisation as depicted in figure 3.4. These characteristics are investigated through propositions 3a to 3c.
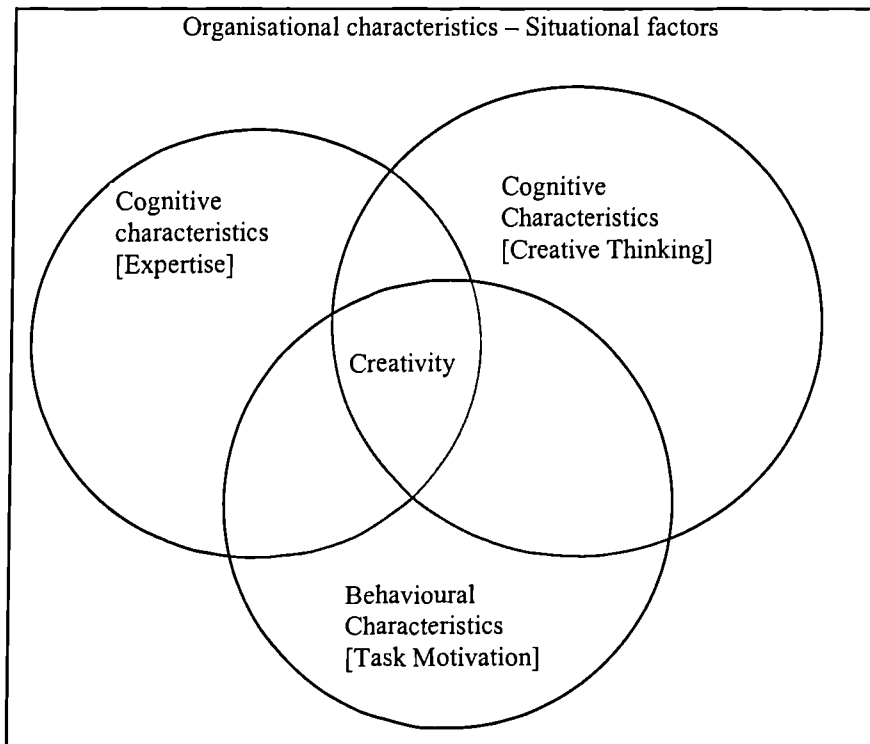
Figure 3.4: Antecedents of Creativity - Organisational and individual factors (Adapted from Amabile, 1997)

Cognitive characteristics of creativity – Individual intelligence

Glynn (1996) argues that intelligence is the foundation for all creative work. Intelligence reflects the two cognitive components of creativity, which are expertise and creative thinking (Amabile, 1997).

The first cognitive component is expertise, which refers to factual (declarative) knowledge, technical proficiency and special talents in the task domain. Expertise is viewed as the set of cognitive skills that an individual follows to solve a given problem. As discussed in section 3.5.1, expertise is generally related to the level of education of a person.

In a study of one hundred creative individuals including scientists, artists, writers, politicians and engineers, Csikszentmihalyi (1996) found that the first and foremost characteristic of creative individuals is mastery of a domain of knowledge or skill. Without mastery of a domain, diverse thinking or ideational fluency is not likely to lead to creative outcomes. Thus, it may not only be the amount of intelligence but also the type of intelligence that is of relevance to creativity.

The second cognitive component is creative thinking skills, which involve the ability to take new perspectives on problems by combining and recombining the existing knowledge to create new knowledge. Amabile (1997) argues that even with a high level of expertise, an individual will not produce creative work if s/he lacks creative thinking skills. Creative thinking skills involve the application of flexible rules (heuristics) for taking new perspectives on problems. Thus creative individuals will have procedural knowledge in addition to domain specific expertise. Creative thinking skills form the tacit dimension of individual intelligence (Leonard-Barton and Sensiper, 1998). Thus the creativity necessary for innovation does not derive only from visible expertise, but from invisible pools of tacit knowledge.

An individual's experience in a particular domain influences these tacit analytical skills and develop knowledge for evaluating alternative solutions and decisions (Anderson, 2000). Herbert Simon has argued that the reason an expert can solve a problem more readily than a novice is because the expert has in mind a pattern born of experience (Leonard-Barton and Sensiper, 1998). However, Stein (1989) identified both positive and negative effects that previous experience had on creativity. According to Stein (1989), negative effects arose when previous knowledge and learning lead to "functional fixedness". In the same way, Leonard-Barton (1995) identified that the ingrained patterns of thinking about the world can become barriers to thinking in different ways thus core capabilities becoming core rigidities. Thus, it becomes important not only to build tacit skills and experience but also to recognise when and how to destroy them and allow new ones to emerge.

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 3a: Individual creativity is influenced by two cognitive characteristics: (a) when there is task domain intelligence (declarative knowledge) and (b) when there is flexibility in combining rules (procedural knowledge).

Behavioural characteristics - Intrinsic motivation and personal orientation
Amabile (1997) argues that although the two cognitive components determine what a person is capable of doing, it is the motivation component that determines what that person will actually do. Motivation can be either intrinsic or extrinsic. Intrinsic motivation occurs when deep interest and involvement in the work drive a person, whereas extrinsic motivation is when a person is driven by the desire to attain some goal such as achieving a promised reward. Intrinsic motivation is defined as the degree to which an employee is self-motivated to perform effectively on the job (Eby *et al*, 1999; Hackman and Oldham, 1975).

A person may work on something because it is interesting, involving, exciting, satisfying or personally challenging (Amabile, 1997). Amabile (1997) suggests that intrinsic motivation is the primary factor that leads to creativity, rather than the extrinsic motivation by expected evaluation, competition with peers, dictates from superiors or the promise of rewards.

Creativity is also influenced by people's overall personality profiles. Intrinsic motivation resides in a person's own personality (Amabile *et al*, 1994). Examples of personal qualities of creative individuals have been collated by Shallcross (1981). Among the personal attributes that are characteristic of creative people are openness to experience, independence, self-confidence, willingness to take risk, sense of humour or playfulness, enjoyment of experimentation, sensitivity, lack of a feeling of being threatened, personal courage, unconventionality, flexibility, preference for complexity, goal orientation, internal control, originality, self-reliance and persistence (Amabile, 1996). Another perspective on the personal qualities of creative individuals is described in Sternberg *et al*'s (1997) 'confluence model', in which six factors converge: intellectual abilities; knowledge; styles of thinking; personality; motivation and environment.

Amabile (1997) suggests that creativity is most likely to occur when people's skills coincide with their interests and their passions. Therefore it is important to match people to work that utilises their intrinsic motivational aspects.

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 3b: Individual creativity is influenced by two behavioural characteristics: when individuals have (a) a high intrinsic motivation and (b) personal orientation toward creativity.

Situational characteristics – problem novelty and organisational orientation
Often creative ideas involve combining seemingly unrelated things (Sternberg *et al*, 1997). When the problem is new, expertise allows an individual to generate and evaluate potential solutions. Also, creativity is favoured when tasks are heuristic (as opposed to algorithmic) and when circumstances are unfamiliar, unusual or novel.

Amabile (1997) argues that the social environment can influence both the level and the frequency of creative behaviour. According to Cummings and Oldham (1997), most employee behaviour is a function of both the person and the place. Some environmental contexts allow individuals to use their high creative potential, whereas others do not. Bower (1965) argues that the work atmosphere conducive to creativity and innovation requires participation and freedom

of expression as well as performance standards. Similarly, Amabile *et al*'s (1996) research that assessed the climate for creativity suggests that environmental stimulants to creativity include freedom, positive challenge, supervisory encouragement, work group supports and organisational encouragement. Consistent with this view, Woodman *et al* (1993) hypothesise that organisational efforts at creativity should impact innovation positively.

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 3c: Individual creativity is influenced by two situational characteristics: (a) when the problem is novel, unfamiliar or heuristic and (b) when an intelligent approach to problem solving is expected and valued.

3.5.5 Enabling Conditions

Glynn (1996) argues that creativity alone is not sufficient for innovation, but that enabling conditions are needed to facilitate innovation in an organisation. Enabling conditions are the availability of opportunities and absence of constraints that affect the innovation process. Amabile (1997) argues that enabling conditions influence the motivation of individuals.

Based on her previous research on creativity Amabile (1997) concludes that individual creativity activities are encouraged by the presence of organisational factors such as sufficient resources and requisite power, whereas organisational impediments and excessive workload pressure hampered creativity.

Similarly, Cummings and Oldham (1997) argue that in order to encourage innovative performance, organisations need a two-factor approach. First managers need to consider the personal characteristics of employees. Second, employees need to be surrounded by a *context* that nurtures their creative potential.

Cummings and Oldham (1997) identify three key features of the job context that facilitate the creativity of individuals: job complexity, supportive and non-controlling supervision and stimulating co-workers. An experimental study by Cummings and Oldham (1997) found that organisational conditions such as stimulating co-workers, autonomy and constructive feedback enabled employees to take advantage of their creative potential. In contrast, when employees worked under constraining conditions such as simple jobs, controlling and non-supportive supervisors their creativity was reduced.

Extrinsic motivational factors such as certain types of incentives, recognition and feedback enhance performance. Positive outcomes can also result from rewards other than financial compensation. Managers may receive promotions or other forms of recognition, which may enhance their reputations and the probability of increased future income (Barney and Hesterly, 1996). Also, the job market may view the previous associations of individuals with success or failure as information about their talents (Fama, 1980). On the other hand other types of conditions such as rewards that attempt to control a person's behaviour, feedback and recognition will be detrimental to a person's innovative performance because they undermine a person's sense of self determination (Amabile, 1997).

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 4: Individual creativity results in innovation under four main enabling conditions: (a) when there is opportunity for creative expression (b) when there is an absence of constraints (c) when there are adequate resources and support to develop ideas and (d) when there are incentives that enhance intrinsic motivation.

3.5.6 Organisational and Situational Context

Organisational and situational context is concerned with the way the organisational structure facilitates innovation (Glynn, 1996). Organisational structure encompasses an organisation's culture, formal and informal processes and the infrastructure (Roos et al, 1997). Cummings and Oldham (1997) assert that only by fostering a context that nurtures creative potential can organisations improve innovative performance. Therefore organisations must structure their employees' environment in order to bring out their creative potential.

Culture provides individuals with a framework in which to interpret events. The culture evolves in an organisation and is a series of rites, symbols and norms (Roos et al, 1997) that define the orientation of the organisation. Amabile (1997) argues that organisations have a basic orientation that motivates them to innovate (or not). Aspects of organisational orientation include a value placed on innovation in general, an orientation towards risk, a sense of pride in the organisation's members and what they are capable of achieving and an offensive strategy of taking the lead toward the future. Organisations that have an orientation to innovation tolerate ambiguity, value diversity in perspectives, value innovation and accept risk taking (Amabile, 1988; Glynn, 1996). An organisational culture can impede creativity through internal political problems, harsh criticism of new ideas, destructive internal competition and an overemphasis of the status quo (Amabile, 1997).

Organisational processes are activities and procedures carried out within the organisation. The shared learning that comes out of these processes initiate organisational innovation through the creation of new knowledge (Nonaka and Takeuchi, 1995). In turn, learning is embedded in the various operating processes, methods of communication and shared understandings about how work is to be done (Levitt and March, 1988). As a result, knowledge develops deep within the organisation over its history (Teece, 1998), adding to the organisation's capabilities for innovation.

Infrastructure facilitates the communication and information-flows of the organisation, connecting individuals at all levels (Roos et al, 1997). To connect individuals and teams, communication in the innovative organisation is based on consultation rather than command and its content consists of information and advice rather than instructions (Dougherty, 1996). A combination of culture, processes and the infrastructure, which together form a unique competence, provides an innovative context.

Amabile (1997) identifies leadership and management practices as an aspect of the organisational structure that is necessary for innovation. A study by Amabile (1997) and colleagues of work environments surrounding project teams in a large high tech company highlighted the importance of management practices such as providing challenging work, work group supports, supervisory encouragement and freedom. A democratic and participative leadership style is conducive to innovation (Nystrom, 1979), as well as the leaders' vision (Cook, 1998). Leaders can influence organisations by shaping thoughts, perceptions and actions of employees and other stakeholders of the organisation. They can also create conditions that influence employees' emotion, behaviours and cognition (Staw and Sutton, 1992).

Mintzberg et al (1998) identify attributes of innovative organisational context as highly organic structure with little formalisation of behaviour. Organisational size, complexity and formalisation are considered obstacles to innovation (Aiken and Hague, 1971; Glynn, 1996). In a similar vein, Quinn (1985) argues that small companies tend to be more oriented toward innovation than large complex ones.

Based on the above discussion Glynn's (1996) proposition is summarised as:

Proposition 5: Organisational innovation is influenced by two situational conditions: (a) high organisational orientation to innovation and (b) when situational factors favour the expression of innovation.

3.5.7 Collaborative Business Intelligence

Collaborative partnerships between organisations exist to link entities that contribute their competencies to a temporary collaboration (Clegg and Hardy, 1996). Organisational boundaries expand as individual entities merge in networks (Powell, 1990), virtual corporations (Byrne, 1993), co-operative partnerships such as joint ventures (Harrigan, 1985) and strategic alliances (Kanter, 1990). These new organisational forms offer opportunities for radical innovation and commercialisation, through a variety of ways (Cohen and Fields, 1999).

Teece (1988) points out the importance of inter-organisational relationships and linkages to the development and profitable commercialisation of innovations. Alliance relationships bring more perspectives and ideas, enable the access to the requisite resources and technologies and realise the economic synergy among the partner organisations. Relationships with external stakeholders such as customers, suppliers and business partners are built through long-term exchanges of information, goods and services (Roos *et al*, 1997). Kogut and Zander (1992) argue that a firm's innovative-capabilities rest in the way it structures its relationships among individuals, within and between groups and among organisations. Similarly, the theory of innovation put forward by Pennings and Harianto (1992) assumes that innovation emerges from a firm's accumulated stock of skills (internal innovative capabilities) and its history of networking (external innovative capabilities).

The primary economic incentive to engage in alliance partnerships is to exploit resource complementarity (Kogut, 1988). The combined economic value of resources owned by two or more firms is greater than their economic value separately. These resources may be in the form of access to leading edge technical developments in new fields (Barney and Hesterly, 1996). Clegg and Hardy (1996) identify several motivations for entering into alliance partnerships. They include shared risks, accelerated technical progress, established market linkages and resources for subsequent product and service development. Customers, suppliers and alliance partners can become insiders and be tapped systematically for ideas and insight (Kiernan, 1993).

Organisational intelligence results in innovation when a variety in perspectives (Wanous and Youtz, 1986), such as those of customers and alliance partners as well as employees, can stimulate further idea generation. McLeod *et al*, (1997) found that variety of perspectives and experiences represented in heterogeneous teams contribute to the production of high-quality ideas and stimulate further idea generation. Similarly Cox and Blake (1991) have observed that cultural diversity may be related to increased organisational creativity and flexibility. Although these researchers focus on cultural diversity, different organisational settings can be taken as having cultural diversity that stimulates idea generation.

Innovative organisations must respond continuously to a complex and unpredictable environment. Thus, firms that actively create value from their intellectual capital do so by aligning their resources with the firm's external environment to ensure that their resources and capabilities are focused on what the market demands (Collis and Montgomery, 1995). On a similar note Bacon *et al* (1994) assert that organisations need to conceptualise the innovation so that its design reflects among other things the customer needs, technological capability and the firm's unique competencies.

Understanding customer needs is essential to business success. Studies conducted by Litman and Lohrmann (2002) suggest that effective innovation develops hand-in-hand with customer demand. They conclude that successful companies in their studies have aggressively innovated their product lines to meet the needs of consumers. Moreover, market information is 'sticky' or embedded in a context retrievable only by hands on interaction within the context (Von Hippel, 1994). Dougherty (1996) argues that linking customer needs with organisation's capabilities is necessary to create a viable new product or service (Dougherty, 1996). Customer's needs and values are integrated into the innovative process when the project members collaborate with customers over the product's conceptualisation and operationalisation (Dougherty, 1996). According to Clarke and Fujimoto (1991), product integrity has both internal and external dimensions. Internal integrity is the consistency between the function and structure of the product such as components match and work well together. External integrity is a measure of how well a product's function and structure fit the customer's objectives and values.

Thus, it appears that companies are likely to have several motives for exploiting external collaborative partnerships. Based on the above discussions, the rationale for collaboration can be grouped into technological, organisational and market motives.

However, external partnerships raise issues of ownership, control and a fair allocation of costs, benefits and risks. Companies must have both the mind-set and organisational structures to encourage and facilitate cross-disciplinary collaboration and learning (Clegg and Hardy, 1996). Such organisations are designed on a distributed (analogous to distributed computing) model, around an internal network of partner units, facilitated by electronic forms of communication. Mutual interests of partners have to be designed into the network. Leadership has to be team based, which will require skills in team building, conflict resolution and problem solving. Moreover, information must be made available through decentralised circuits to all levels of employees relying on both 'hard' technological networks and 'soft' relational networking competence in and between organisations (Clegg and Hardy, 1996).

Thus, the following proposition is added as:

Proposition 6: *Innovation is influenced by collaborative business intelligence in the form of: (a) collaborative relationships with business partners and (b) collaborative relationships with customers.*

This section illustrated how individuals and situational factors interact to facilitate innovation. On the basis of the above discussions it appears that the most important elements of the innovation process stem from the complex mosaic of individual, group, organisational and external attributes influenced by the situational context (both enhancing and constraining performance). Table 3.4 below represents an attempt to summarise the arguments in this chapter and illustrates the relationship and interactions of individuals (human capital) with contextual conditions (organisational capital) and external factors (relationship capital). However, such a table cannot richly capture the dynamic nature of relationships between the three intellectual capital dimensions.

Constructs	Human Capital	Organisational Capital [Enabling Conditions and Organisational Context]	Relationship Capital [Collaborative Relationships with Customers and Business Partners]
Human Capital — **Individual Intelligence**	An individual's education, expertise and experience. Learning. Tacit and explicit knowledge.	Patterns of motivation and action created as a result of contextual influences.	An individual's ability to articulate ideas within and across domains.
Organisational (collective) Intelligence	Common frames of thought and action held by organisational members. Distinctive competencies. Context-specific knowledge.	Influences sense-making processes and creative outcomes. Accumulates and retains collective experiences.	Organisational ability to recognise the value of new knowledge. Capitalises on potential synergies.
Creativity	Problem perception. Idea generation. Evaluation of potential solutions.	Effect of the social environment on the development and utilisation of novel solutions. Build new competencies from some aspects of the existing ones.	Utilisation of new knowledge in creative ways. Form links with customers to assess their unique preferences.
Individual Context (Attitudes and Orientation)	Creative personalities and behavioural preferences. Intrinsic motivation.	Contributes to the function of motivation and ability.	Facilitates conformity and/or change among collaborative partners.
Organisational Capital — **Organisational Context**	Depicts the processes at work among actors in an organisation. Organisation's disposition towards risk.	Organisational policies, structures, routines and climate that bring about creative and/or habitual actions.	Networking facilities. Fluid, flexible and integrative structures to facilitate diverse knowledge.
Enabling Conditions	Enhance or constraint an individual's creative intentions.	Availability of opportunities and absence of constraints. Resources, rewards and incentives.	Ability to create conditions for effective communication and participation in joint ventures. Ability to resolve conflicts before collective action can be taken.

	Collaborative Business Intelligence	Participation of firms from diverse domains to offer creative solutions.	Collaborative conditions that enables diversity in perspectives.	Joint influence of multiple partners, each with their own expertise to facilitate creativity and innovation.
Relationship Capital				

Table 3.4: An Illustration of Interactions among IC Factors

The above relationships will be examined in the empirical study described in Chapters 5 and 6 in an attempt to identify the value creating effects of these relationships. In preparation for the testing of the propositions as discussed above, the next section sets out the operationalisation of the constructs.

3.6 Operationalisation of the Constructs

The empirical study in this research is designed to test the above propositions. Testing the theoretical propositions requires evaluating the various constructs. The relationship between the constructs and the possible indicators of these constructs was identified via a review of the existing literature on innovation, creativity and intellectual capital.

Individual intelligence

Intelligence or knowledge denotes an individual's capacity to act in various situations (Sveiby, 1997). Sveiby (1997) suggests that the best way to describe knowledge in the business context is the concept of competence, which embraces factual knowledge, skill (expertise), experience, value judgements and social experience. Intelligence is open to assessment in general, as individuals and groups can be judged by their "track record" of performance (Leonard-Barton and Sensiper, 1998). More specifically, individual intelligence will be assessed in this research in the three categories of domain specific knowledge, social knowledge and procedural knowledge as follows:

a) Domain specific knowledge indicates the academic or technical knowledge of the task or the problem (Roos et al, 1997). Thus, the distinct indicators of an individual's domain specific knowledge are:

- Education – familiarity with facts and information of the domain
- Experience – practical knowledge developed through training, reflection, mistakes, repetition etc., gained within the company and within the industry
- Expertise – deep technical know-how acquired through training and practice

b) Social, political and interpersonal knowledge represents the ability of an individual to influence the formal and informal systems of the organisation and its environment (Leonard-Barton, 1995). Bartlett and Ghoshal (1997) found that such knowledge requires an understanding of the organisational context and how it operates. Their analysis of twenty large companies provides evidence, that personal characteristics of management, which included intellectual leadership, team leadership and social competence added value to activities of front-line entrepreneurs in the organisation. Thus, assessment of social, political and interpersonal knowledge focuses on the personal characteristics of key project members, as well as on the level of their involvement in the project.

c) Procedural knowledge consists of analytical skills and stored information about if-then rules that provide situation specific solutions to problems (Nahapiet and Ghoshal, 1998). Individuals develop procedural knowledge through experience in a specialised domain (Anderson, 2000). Experience in a particular domain influence analytical skills and develop knowledge for evaluating alternative solutions and decisions (Anderson, 2000). Thus, an individual's experience is considered an indicator of procedural knowledge.

Organisational intelligence represents the shared team experience held by organisational members. After Berman *et al*, (2002), this research will utilise the number of years each team member has worked in the company as an indicator of the shared experience of the members.

Creativity is recognised in the literature as novel and useful outcomes. For instance, Amabile (1997) defines creativity as the production of novel and useful ideas. Similarly Cummings and Oldham (1997) define creativity as generation of a product, service or process that is both novel and useful. Ford (1996) also views creativity as outcomes that are novel and valuable. Thus, creativity that leads to innovative performance would be operationalised in this study as the amount and extent of the creative (novel and useful) activities carried out by the project members. Another indicator of creativity is an individual's positive sense of challenge in the work (Amabile, 1997).

Intrinsic motivation of individuals is related to perceptions of meaningfulness of job, responsibility, knowledge of results and empowerment (Eby *et al*, 1999; Hackman and Oldham, 1976). Since the level of intrinsic motivation depends on the basic enjoyment of a person's work, an indicator of intrinsic motivation would be the job satisfaction enjoyed by a person.

Personal orientation relates to personal characteristics of individuals. A creative personality is characterised by self-discipline, orientation toward risk-taking, tolerance for ambiguity, perseverance in the face of frustration and a relative lack of concern for social approval (Amabile, 1997). This research would seek the perception of project members to assess the presence or absence of these individual characteristics.

Problem novelty reflects doing something for the first time or creating new knowledge (Woodman *et al*, 1993). Creativity is favoured when tasks require analytical skills and when circumstances are unfamiliar, unusual or novel. This research would examine the various tasks carried out by the project members to assess the novelty of each task.

Organisational orientation denotes the support for creativity and innovation throughout the organisation. As discussed in the previous section, the organisational orientation to innovation would correspond with a value placed on creativity and innovation, an orientation toward risk(versus an orientation toward maintaining the status quo), a sense of pride in the organisation's members and what they are capable of achieving and an offensive strategy of taking the lead toward the future (versus a defensive strategy of simply protecting the organisation's past position). This research would seek the perception of project members to assess the presence or absence of these individual characteristics.

Enabling conditions reflect the work conditions characterised by the availability of opportunities and absence of constrains that affect the innovative process. An indicator would be sufficient resources to aid work (i.e. sufficient time for producing novel work, people with necessary expertise and funds allocated) (Amabile, 1997). Other indicators would be recognition, rewards that are perceived as fair and equitable and participation in important work related decisions (Bandura, 1986; Greenberg, 1990).

Organisational and situational context refers to the organisational structure that facilitates innovation. Indicators are the culture, management practices, availability of systems and processes and connectivity through communication and information flows.

Collaborative business intelligence is cultivated through relationships with customers, suppliers and business partners that influence creative business solutions. This empirical study will examine the types of links formed by the organisation with business partners, suppliers and customers. The links will also be examined with respect to the competence they provided.

Long term relationships with customers will be assessed by the indications of customer satisfaction and the potential for repeat business.

Value Creating potential of the project was evaluated by assessing five key performance areas. In order to create value, the organisation must provide value to the customer, by solving customer problems. Higher the customer benefit created by a product or service, the more value that product or service brings to the company (Andriessen and Tissen, 2000). Therefore, value is grounded in specific customer related aspects and operationalised as the assessment of the project members' perception of five aspects of success measures that the innovative service brings to the organisation. They are revenue growth, competitive advantage, customer satisfaction, company reputation and potential in terms of increasing demand for the company's services.

The propositions, constructs and their indicators are summarised in Table 3.5 below, which formed the basis for the interview agenda as shown in Appendix A.

Proposition	Construct	Indicators
P1 – Types of intelligence	Domain specific intelligence	Professional education, duration of employment, number of years in the industry sector and on-the-job experience.
	Social, political and interpersonal intelligence	Personal characteristics (intellectual leadership, team leadership and social competence) and the level of involvement in the project.
	Procedural knowledge	An individual's experience.
P2 – Level of intelligence	Individual intelligence	Track record of performance.
	Organisational intelligence	Shared experience (total number of years each team member has worked in the company).
P3 – Creativity	Individual creativity	Creative outcomes of project members.
P3a – Cognitive skills	Domain specific intelligence (declarative knowledge)	As above.
	Flexibility in combining rules (procedural knowledge)	As above.
P3b – Behavioural Characteristics	Intrinsic motivation	Job satisfaction.
	Personal orientation toward creativity	Personal characteristics of project members.
P3c – Situational Characteristics	Problem novelty	An assessment of the novelty of key tasks carried out by project members.
	Organisational orientation	Support for creativity and innovation.
P4 – Enabling Conditions	Opportunities and constraints	Assessment of work conditions.
	Resources and support	Assessment of resources and support.
	Rewards that enhance intrinsic motivation	Assessment of rewards and incentives.
P5 – Organisational and Situational Context	Organisational structures	Assessment of culture, management practices, information flows and routines and processes.
	Organisational orientation	Assessment of the support for innovation.
P6 – Collaborative Business Intelligence	Relationships with business partners	The types and the number of links formed by business partners.
	Relationships with customers	Customer satisfaction and repeat orders.
Value Creation	Value Creation	Five aspects of success measures (revenue growth, competitive advantage, customer satisfaction, company reputation and the potential for future business).

Table 3.5: Propositions, Constructs and their Indicators

Literature suggests that evaluation of innovations cannot be limited to the project level, since the success of an innovation may depend on how well it embodies the firm's unique competencies (Cooper and Klein-Schmidt, 1987; Crawford, 1983; Dougherty, 1996). The innovative project under evaluation in this empirical study was selected because it encompasses all functions of the organisation, in which everyone focused on the development of the new service. Multi-functional project members collaborated among themselves and with customers and alliance partners over the service's conceptualisation and operationalisation.

3.7. Conclusions

This chapter has presented a theoretical framework based on innovation theory to explore how IC factors can be leveraged to create value in organisations. In this respect, this research identified a theoretically derived model of intelligence and innovation based on the work of Glynn (1996). It was argued that the relevance and applicability of the model to the empirical investigation rests on the model's assumption that an organisation's human capital, as represented by its individual and collective intelligence, constitutes a critical capability that needs to be supported by organisational systems for successful innovative performance. As evidenced in the literature review in Chapter 2, this view is consistent with the literature on intellectual capital. Furthermore, the innovation theory proposed by Glynn (1996) outlines specific individual, social and contextual conditions that affect how intelligence is utilised within an organisation, providing a model to understand the antecedents of organisational value creation.

This research highlights a possible weakness of Glynn's (1996) model in that it does not explain the impact of collaborative business intelligence on innovative performance. It was argued in this research that collaborative business intelligence gained from customers and business partners brings more perspectives and ideas to the organisation and therefore is a source of innovation. Moreover, innovation depends on creative problem solving where insights are channelled to respond to the particular needs of customers. In addressing the limitation identified, this research extends Glynn's (1996) model to better represent an organisational context that incorporates the interactions with external stakeholders such as customers and business partners. Thus, the relationship between innovation and collaborative business intelligence was argued and supported by a proposition (proposition 6).

Finally, whereas Glynn (1996) draws on literature on psychology to explain the factors that influence innovative performance, this research additionally draws on the literature on intellectual capital to further explore these factors. Thus, the chapter has de-contextualised the ideas, constructs and relationships of the original model, in terms of those of the intellectual

capital theory. In doing so, outlining the operationalisation of the constructs in preparation for the empirical examination that is presented in Chapters 5 and 6.

Research Methodology

4.1 Introduction

The previous chapters discussed the research questions and the theoretical framework developed for this research study. The aim of this chapter is to link the proposed study to the general principles regarding the conduct of the research enquiry. In this vein, this chapter provides a rationale for the researcher's motives and justifications that guide the design of this research. Sections 4.2 – 4.4 provides a rationale for the philosophical assumptions of this research which were firmly grounded in the qualitative interpretivist tradition. Section 4.5 discusses the basis for selecting a research approach. Section 4.6 describes case study research as the appropriate approach to conduct this empirical enquiry and examines its various forms, strengths and shortcomings. Finally, section 4.7 describes the explanatory case study approach as operationalised in this research, with particular attention being paid to the four phases of the research design. Its sub-sections discuss the various activities within each phase in terms of the research question, the study protocol, pilot study, site selection, data collection and analysis as well as the methodological rigour. Section 4.8 concludes this chapter.

4.2 Underlying Research Assumptions

Research is the systematic investigation to establish facts or collect information on a subject in such a way that it gives rise to new insights that are backed up by appropriate evidence (Cornford and Smithson, 1996). Many authors (e.g. Galliers, 1993; Mingers, 2001; Walsham, 1995) assert that one of the important aspects of a research study is the conscious choice of an appropriate process of systematic exploration. This process that consists of a structured set of guidelines to assist in generating valid and reliable research results is known as the research methodology (Mingers, 2001). A methodology makes implicit or explicit assumptions about the nature of the world and of knowledge. Academic research requires that this research methodology, as well as the results of investigations, be set out and communicated to the wider

community of interested parties in a manner that their internal validity and external value are expressed (Cornford and Smithson, 1996; Marshall and Rossman, 1999; Phillips and Pugh, 1994). It follows then, that success of research is achieved through careful attention to process as well as by intellectual activity.

Galliers (1995) observes that too often researchers pay more attention to details of research design within an approach than to a questioning of the appropriateness of the underlying research philosophy and the approach itself. With this concern in mind, the next sections of this chapter set out the justification for the choice of an interpretive qualitative perspective adopted in this research.

4.3 Justification for the Adoption of an Interpretivist Philosophy

As mentioned above, the research methodology reflects the major decisions made by the researcher to determine the best approach to the research questions posed and is dependent on a wide range of philosophical assumptions regarding the phenomenon under study. A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used. The underlying philosophical assumptions about what constitutes valid research revolves around the concepts of ontology (assumptions about the phenomena under study), epistemology (the nature of valid knowledge), ethics or axiology (what is valued or considered right) and methodology (a set of activities to generate valid research results) (Mingers, 2001). This basic set of beliefs that guides a researcher's action is termed a paradigm (Guba, 1990).

Two major research philosophies have been identified in the Western scientific tradition as appropriate for social sciences research, namely positivist (sometimes called scientific) and interpretivist (also known as anti-positivist) (Galliers, 1993). Orlikowski and Baroudi (1991) suggest three broad philosophical assumptions: positivist, interpretivist and critical. In the past the use of these perspectives in research studies have been treated as mutually exclusive and therefore unable to be combined and linked. However, in the practice of social science research, the distinctions are not always clear and sharp. There is further debate as to whether these philosophical perspectives can be accommodated within the one study. For instance, Mingers (2001) argues that research results will be richer and more reliable if different research approaches, from different paradigms, are combined together.

The brief discussion below compares and contrasts the assumptions, values and shortcomings of the three philosophical traditions of positivism, interpretivism and critical theory, providing the basis for the justification for adopting an interpretive stance in this research.

Positivism is a theory of knowledge that assumes that observations of phenomena under study can be made objectively and rigorously and the research aims to give rise to objective facts (Galliers, 1991). The theory holds that the only reliable approach to knowledge accumulation is empirical falsification through objective hypothesis testing of rigorously formulated causal generalisations (Popper, 1959). Positivist principles emphasise the use of sampling techniques, the measurement of outcomes and the development of causal models with predictive power (Myers and Avison, 2002). According to Orlikowski and Baroudi (1991), positivist studies are characterised by formal hypothesis testing, quantifiable measures of variables and the drawing of inferences about a phenomenon from a sample to a stated population. In their review of IS research studies, Orlikowski and Baroudi (1991) further identify descriptive studies within the positivist category where the researchers presented objective, factual accounts of events to illustrate some issue of interest to the IS community. In these descriptive works, researchers attempted no interpretation of the phenomena under investigation (Orlikowski and Baroudi, 1991).

In contrast, **interpretivist approaches** emphasise human interpretation and understanding as a part of valid knowledge. Interpretive researchers reject the use of quantitative, positivist methods and assumptions in social scientific enquiry because of (among other things), the possibility of many different interpretations of social phenomena and the impact of the researcher on the social system being studied (Galliers, 1991). This view is confirmed by Orlikowsky and Baroudi (1991), in their assertion that in contrast to the positivist, descriptive studies mentioned above, interpretive researchers reject the possibility of an objective or factual account of events and situations. Instead these researchers seek an understanding of the deeper structure of a phenomenon, which is then used to inform other settings. On a similar note Walsham (1993) argues that interpretive research attempts to provide an understanding of the context of research and the process whereby the phenomenon under study influences and is influenced by the context. Walsham (1993) observes that interpretive researchers allow concepts to emerge from field data rather than entering the field with preconceived theories. However, many authors argue that researchers can and must draw on theory and employ it in interpretive research, although, without assuming that it represents final truth in that area (Miles and Huberman, 1994; Walsham, 1995; Yin, 1994). One of the many criticisms of interpretive methods is that they rely on the interactional and judgmental abilities of the human enquirer.

Critical research represents the more recent normative turn in social science and promotes openly ideological forms of enquiry (Greene, 1998). Critical researchers attempt to illuminate the historical, structural and value bases of social phenomena. The main aim of critical research

is to critique the status quo, whereby the restrictive and alienating conditions within the social systems are exposed (Myers and Avison, 2002). Critical research focuses on the oppositions, conflicts and contradictions in society and seeks to eliminate the causes of alienation and domination. Critics of this tradition complain that it is difficult to evaluate critical enquiry because external standards of validity and reliability are not followed (Denzin, 1998).

Table 4.1 summarises the major characteristics of the above three philosophical perspectives.

Philosophical Perspective	Ideological Framework	Key values promoted	Preferred methods	Shortcomings
Positivist research	Objectivity	Theoretical, causal knowledge	Quantitative: experiments, statistical surveys, causal models with predictive power	Cannot account for the complexities of human behaviour
Interpretive research	Pluralistic view: multiple ways of knowing	Understanding of the context, diversity of perceptions	Qualitative: case studies, interviews, observation, document review	Researcher's assumptions and values are deeply embroiled in the phenomenon
Critical research	Emancipation	Empowerment, social change	Participation: stakeholder participation, historical analysis, social criticism	Tend to be deterministic. Ambiguity of evaluation of theories.

Table 4.1: Major characteristics of research perspectives (Adapted from Greene, 1998)

Based on the above discussion, the justification for adopting an interpretive stance is as follows:

- The research questions as set out in Chapter 1 emphasise the investigation of *how* intellectual capital factors impact on value creation in organisations. Intellectual capital is created through a context-specific and subjective process emerging from previous experiences and current events. Investigating this process requires the researcher to view facts and values as intertwined and therefore does not lend itself to the scientific method of enquiry.

- The context dependency of this research distances itself from the positivist paradigm and aligns it with interpretivism.

- The literature review presented in Chapter 2 and the theoretical model developed in Chapter 3 to investigate the intellectual capital factors indicate that innovative performance is strongly linked to the attitudes, beliefs, behaviours and group norms of organisational

members. The research also involves the investigation of individual characteristics and behaviour associated with creativity. Uncovering these tacit aspects of organisational life strongly suggests the need for understanding the fuzzy, ill-structured world of complex organisations. In order to capture the richness and depth required, an interpretative and subjective stance is adopted in this research.

- As this research does not specifically focus on the ways in which intellectual capital can emancipate or empower organisational members, the critical theory and other similar theories do not apply to this research.

4.4 Justification for Use of Qualitative Research

Another perspective of research in the social sciences is the divide between quantitative and qualitative research. This divide reflects the traditional split between the positivist and anti-positivist epistemological perspectives. Quantitative research emphasises the use of measurement to describe objects and relationships under study. Furthermore, quantitative enquiry is purported to be within a value-free and time and context independent framework. In contrast, qualitative research stresses the socially constructed nature of reality, the close relationship between the researcher and what is studied and the context that shapes inquiry (Denzin, 1998). According to Miles and Huberman (1994), qualitative research is based on words rather than numbers.

"Words, especially organised into incidents or stories, have a concrete, vivid, meaningful flavour that often proves far more convincing to a reader – another researcher, a policymaker, a practitioner – than pages of summarised numbers".

Miles and Huberman, (1994, pp1)

Quantitative researchers aim for large numbers of context stripped data and seek statistical significance. Examples of quantitative methods used in the social sciences include survey-based approaches with statistical analysis, laboratory experiments and numerical methods such as mathematical modelling. Qualitative researchers usually work with small samples of people who are studied in-depth in their natural context. Examples of qualitative methods are action research, case study research and ethnography. Qualitative researchers are sensitive to the value of the multiple perspectives and rely upon triangulation of data as a method of validation.

Qualitative research has often been used as a source of hypotheses to be taken up by quantitative researchers for subsequent verification. However, in the social sciences, there has been a growing recognition of the contribution that qualitative studies can make. Patton (1990)

advocates qualitative methods when they represent the best match to the researcher's information needs, such as multiple perspectives and contextualised meanings.

While quantitative research methods are informed by a positivist perspective, qualitative research methods can be guided by a positivist, interpretive or critical perspective (Myers and Avison, 2002). It follows then that a qualitative research method such as the case study can be positivist (Miles and Huberman, 1994; Yin, 1994), interpretive (Walsham, 1993) or critical (Greene, 1998). Figure 4.1 depicts the underlying philosophical assumptions of qualitative research.
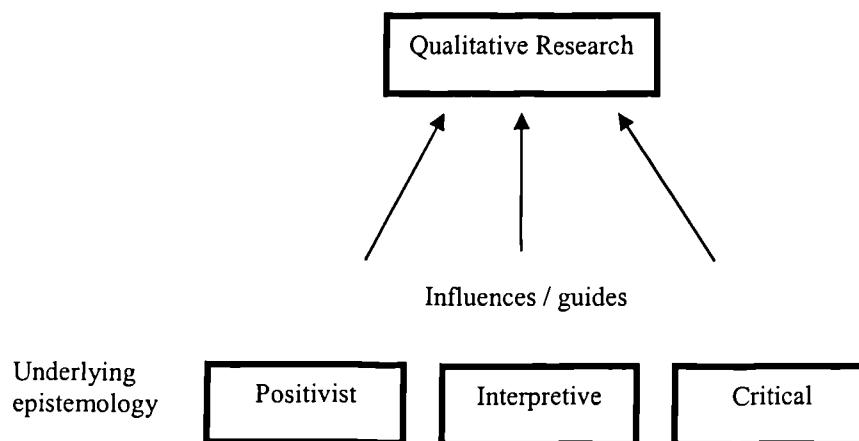
Figure 4.1: Underlying Philosophical Assumptions of Qualitative Research (Source: Myers and Avison, 2002)

Based on the above discussion, the justification for adopting a qualitative approach in this research is as follows:

- The premise of this research is that better understanding of the way intellectual capital factors interact will lead to better strategies that create value in organisations. However, the underlying mechanisms through which intellectual capital generates value are by no means clear. Qualitative research can be especially instructive in the examination of the processes of how value generation is accomplished.

- A growing body of empirical research on intellectual capital has been conducted within the tradition of quantitative research in which it is shown that firm specific intellectual capital factors lead to value creation (e.g. Bart, 2001; Bontis, 1998; Bontis et al, 2000; Hall, 1992). This approach used survey-based research and focused on theory building. Quantitative research on intellectual capital offers huge advantages to the discipline by providing clear-cut specification of causal connections between different dimensions of intellectual capital

factors and various performance outcomes. On the other hand, qualitative research brings to the study of intellectual capital an approach, which sees the variety of meanings associated with individual and collective knowledge.

- By adopting a qualitative approach, this research can allow a different set of questions to be addressed to those addressed by previous quantitative studies. For example, to address the fundamental issue of *how* intellectual factors contribute to value creation within organisations.

- Qualitative research is also sensitive to the contexts of intellectual capital. Through the use of comparative analysis of two cases this research is able to highlight the specific features of context and how they affect value creation.

- A qualitative enquiry will allow the research to address issues that are not readily accessible to a quantitative approach. For example, how the aggregation of individual attributes, thoughts, feelings and behaviours influence the creation and accumulation of intellectual capital. Furthermore, key concepts such as tacit knowledge or capabilities resist direct measurement.

So far, this research has argued for a qualitative mode of enquiry, with the use of an interpretivist philosophy. The next section focuses on selecting an appropriate research approach.

4.5 Selecting a Research Approach

There are many research approaches available to the researcher. Benbasat, et al (1987) suggest that the goals of the researcher and the nature of the research topic influence selection of a research approach. Table 4.2 provides a summary of the range of research approaches identified by Galliers (1991), indicating whether they typically conform to the positivist or interpretivist paradigms. Galliers (1991) uses the term 'research approach' to describe the style of a research study, while a 'method' is the application of techniques for observing events.

Research Approaches	Positivist	Interpretivist
Laboratory Experiments	*	
Field Experiments	*	
Surveys	*	
Case studies	*	*
Simulation	*	
Theorem Proof	*	
Forecasting	*	
Action-Research		*
Futures Research		*
Reviews		*
Role/Game Playing		*
Subjective/argumentative		*
Descriptive/interpretive		*

Table 4.2: Research Approaches in the Context of the Scientific and Interpretivist Philosophies. (Adapted from Galliers, 1991)

Galliers (1991 and 1995) and Galliers and Land (2002) provide detailed discussions of the above approaches. Each approach is a different way of collecting and analysing empirical evidence and has its own advantages and disadvantages. However, these approaches are not mutually exclusive. Yin (1994) suggests that the appropriate approach is determined by three broad conditions:

1. The type of research questions posed;
2. The extent of control the researcher has over actual events, and,
3. The degree of focus on contemporary events.

4.6 The Case Study as a Research Approach

Rouse and Daellenbach (1999) argue that research investigating the resource-base of firms must be done not only on organisations (e.g. through surveys involving multi-organisation, single time-period samples) but also in organisations. Rouse and Daellenbach (1999) note that quantitative methods do not capture the complexity associated with intangible resources and their often sensitive and highly consequential nature. To address this issue, the case study approach was selected as the most appropriate research strategy for this study. Case study

research is a pluralistic method of investigation that provides for systematic observation so that a rich understanding of the context of a phenomenon may be obtained (Cavaye, 1996).

The research questions in this study centres on "how" observed phenomena occur and impact on innovation. This requires an understanding of the nature and complexity of the processes taking place. Furthermore, the researcher has no control over behavioural events within the organisations selected for the study. The focus of the research is on contemporary events, using direct observation and systematic interviewing to record these events. Additionally, by collecting the data personally from different informants, the case research would enable the researcher to uncover issues and relationships not envisaged prior to starting data collection (Cavaye, 1998).

Case study research satisfies the three tenets of qualitative analysis, namely, understanding, describing and explaining a phenomenon of interest. Yin (1994) suggests that a research study may be exploratory, descriptive or explanatory depending on whether they are employed to answer "what", "how" or "why" research questions. The most pertinent criterion for applying the case study approach to this research was its scope for explanation, since the researcher began the study with an initial theory of intellectual capital. Irani et al (1999) argue that case studies may be used as an environment for testing theory. As a result of the literature review a comprehensive theoretical model was developed with related propositions, which provided a theoretical basis for examining the antecedents of organisational value creation in an innovative context. Yin (1994) advocates that the case study enquiry benefits from the prior development of theoretical propositions to guide data collection and analysis. The development of the model and the model itself are described in detail in Chapters 2 and 3 respectively. However, in using a theoretical framework it is important to avoid the possibility of premature closure on the issues to be investigated Bryman (1988).

Benbasat et al, (1987) cite many characteristics of case study research that contribute to a viable approach. Among these are:

1. Phenomenon of interest is examined in its natural setting;
2. Data are collected by multiple means;
3. One or few entities (person, group or organisation) are examined;
4. The complexity of the unit is studied intensively;
5. No experimental controls or manipulations are involved;
6. The focus is on contemporary events;

7. Case research is useful in the study of "how" and "why" questions because these deal with operational links to be traced over time rather than with frequency or incidence.

8. Case studies are more suitable to research an area in which few previous studies have been carried out.

However, like all approaches, the case study research has weaknesses (Yin, 1994). Case study research is seen as a less rigorous form of enquiry than other methods such as experiments or surveys, due to sloppy design, equivocal evidence or biased views that may influence the direction of the findings and conclusions. A second criticism of case studies is that their dependence on a single case provides little basis for scientific generalisation. A third frequent criticism is that case studies are time consuming and labour intensive as they can result in massive, lengthy narrative. Finally, the results of the study can be highly subjective as they depend on the experience and knowledge of the investigator.

These criticisms have been taken into account and steps taken to alleviate each one in the design of this research study. For example, as described in the following sections of this chapter, this research has followed a methodologically sound and rigorous research design, from defining the initial set of research questions, through the collection and analysis of relevant data, to presenting a set of research conclusions. The quality of the design was addressed through the four tests of construct validity, internal validity, external validity and reliability. This research has used a dual case study design to examine and compare findings. A cross-case comparison will enable the researcher to replicate the results and will facilitate a more robust investigation (Yin, 1994). The design of this entire research process is discussed in the next section.

4.7 Case Study Research Design

A research design that is systematic and manageable, yet flexible helps to preserve the implementation flexibility of the study that is a hallmark of qualitative studies (Marshall and Rossman, 1999). The research design is a plan for the conduct of the research study that logically connects the empirical data to a study's initial research questions and to its conclusions (Yin, 1994). Stuart et al (2002) and Yin (1994) state that a research design may follow four main phases as shown below:

1. What questions to study (as indicated by the review of the literature);

2. What data are relevant (as indicated by the study's propositions, study protocol and site selection);

3. What data to collect (as indicated by the unit of analysis); and,

4. How to analyse the results (as indicated by the logic linking the data to propositions and the criteria for interpreting the findings).

The above four-phase procedure was followed when planning the design of this research, which is illustrated in Figure 4.2 and described below.
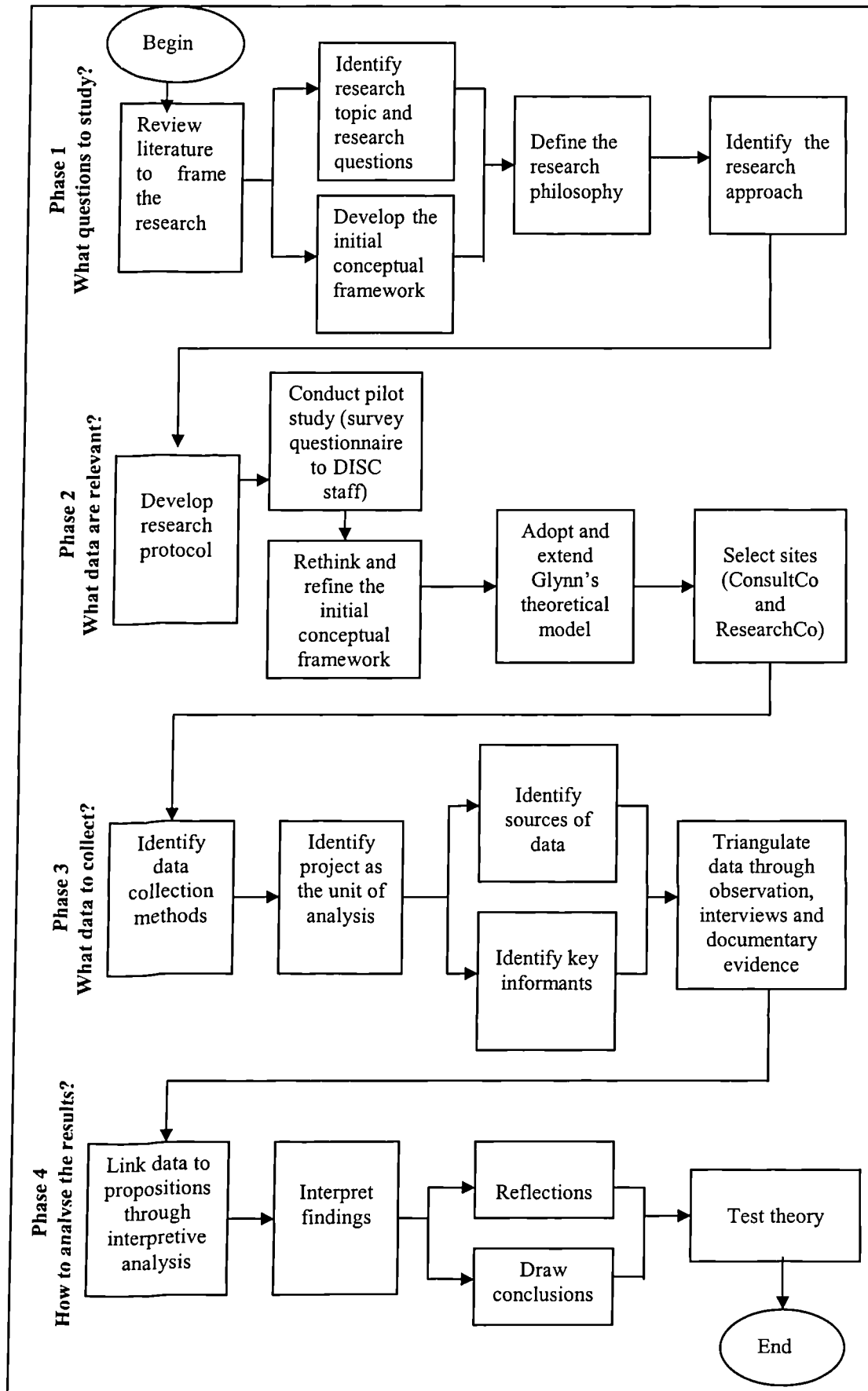
Figure 4.2: The Research Design

Phase 1 - Deciding What Questions to Study

The first phase of the research process involves defining the study questions. Reviewing the existing literature and the related empirical research served as a starting point to identify the study questions by developing an understanding of the research area under investigation. Defining the study question for this research is discussed in detail in section 4.7.1.

The study questions in turn enabled the researcher to clarify the research strategy, in terms of the research philosophy to be adopted in order to demonstrate the assumptions and values the researcher brings to the study and the approach selected. The rationale for the selection of the research philosophy and the research approach has been discussed in sections 4.3 and 4.4 respectively.

Phase 2 - What Data are Relevant

The second phase of the research design involved the development of a case study protocol (see section 4.7.2), the conduct of a pilot study (see section 4.7.3) and the selection of appropriate field sites (see section 4.7.4). These activities helped in deciding what data to be captured for future analysis.

As detailed in section 4.7.3 – Pilot Study, the relevance of data was further clarified when the pilot study highlighted the need for a more robust conceptual framework. As a consequence, Glynn's (1996) theoretical model was adopted and extended as discussed in Chapter 3.

Phase 3 - What Data to Collect

In case study research, data represents the researcher's observations, various documents that the company is willing to provide and records of interviews. The theoretical model (as described in Chapter 3) and the related propositions directed data collection and guided the selection of the unit of analysis, sources of data and key informants. Data collection is described in detail in section 4.7.5.

Phase 4 - How to Analyse the Results

Data analysis is the fourth phase of the research design and involved examining, categorising, tabulating and recombining collected data to address the propositions of the study (Yin, 1994). Much of the important data in this research came from analysing and interpreting the perspectives of the respondents (Walsham, 1995). Walsham (1995) calls the respondent's constructions first-order data and the interpretations of the researcher second-order concepts. "Second order concepts rely on good theory and insightful analysis and mere collection of in-

depth case study data does not provide these concepts in itself". Data analysis is discussed in detail in section 4.7.6.

Various activities carried out within the case study design are described in detail in the following sub sections.

4.7.1 Defining the Research Question

The initial curiosity for research on intellectual capital stemmed from the researcher's direct experience in knowledge-intensive organisations, in which high dependence on practical problem solving by individuals was the norm. It was felt that investigation of the topic of intellectual capital has the potential to contribute to practice. The significance of the research for practice was further established through the literature review. In order to frame the research, a thorough review was carried out in various strands of the literature in the areas of organisational and individual knowledge, intellectual capital, innovation, creativity and organisational theory, behaviour and psychology. The review of the relevant theory as well as the previous empirical studies exposed missing areas and questions raised by the existing literature, which helped to identify the research topic and develop the initial conceptual framework on intellectual capital. Due to the relatively recent attention given to the nature of intellectual capital, any single theoretical tradition could not provide adequate explanation of how intellectual capital factors impact on organisational value creation. Fitzgerald (1991) asserts that research within a young discipline benefits from adopting a wider perspective by taking on board the existing knowledge base in other more established disciplines. In view of this, the conceptual framework surrounding the research questions was developed by placing the concepts of intellectual capital within the context of innovation. The development of the theoretical model is described in Chapter 3.

4.7.2 Case Study Protocol

The protocol encompasses the principal documentation of the study indicating what data are to be collected and is important for several reasons (Yin, 1994) as it:

- Provides the researcher with the necessary focus;
- Ensures that the trail of evidence is thoroughly documented;
- Enables the researcher to anticipate problems, and ;
- Enables others to follow the procedures described by an earlier investigator.

The protocol guides the researcher in carrying out case study research and increases the reliability of the study (Yin, 1994). The development of the protocol for the final case studies was assisted by the use of a pilot study. A brief outline of the protocol followed in this research is as follows:

Overview of the research

This study sets out to provide an empirical examination of the intellectual capital factors in an innovative environment. For this purpose, the study employs a theoretical model that consists of six key propositions and three sub propositions that specify a number of constructs as impacting the innovative process and the relations among them. In testing the propositions, it is not the intention of this research to test a complete model of innovation, but rather to examine the role of intellectual capital in the context of innovation.

The objectives of the research are to identify the antecedents of creativity and innovation, to clarify how these skills contribute to business success and to identify the enabling and constraining conditions on creativity and innovation. Contributions of this research would be in the form of insight that provides a greater understanding of the impact of intellectual capital factors.

Field Procedures

The data collection plan, which sets out the anticipated methods for attaining access to the sites, access to informants, arranging interviews, data collection activities, as well as planning for unanticipated events is provided below:

- Access to the sites and interviewees - as detailed in section 3.7.5 the researcher had unrestricted access to the two sites selected. Field visits were scheduled to coincide with project workshops, review meetings and committee meetings, in which the researcher was an unobtrusive observer.

- Data collection agenda - during these site visits the researcher had the opportunity to carry out informal discussions to explore project member's perspectives and insights on different aspects of the project.

- Interview timetable - formal interviews with key project members were arranged around their work schedules. Participants requested and were provided with the interview guide prior to interviews. This provided them with the opportunity to think about the answers in their own time.

- Providing for unanticipated events - Interviews were rescheduled where unforeseen circumstances prevented the project member from attending interviews. The researcher did not encounter any other unanticipated events.

Case Study Questions

A set of broad questions was developed to examine the propositions as set out in the theoretical model. These questions enabled to focus the researcher's efforts in the data collection process and reflect the full set of concerns of the research enquiry. The protocol questions forced the researcher to identify exactly what data are being sought and helped to design the interview agenda. The broad questions are as follows:

1. What types of knowledge are associated with the innovation process?
2. How do individual intelligence and personal attributes contribute to the project outcome?
3. How is individual creativity nurtured and supported within the organisation?
4. To what extent are the cognitive characteristics of declarative knowledge and procedural knowledge evident in the project members?
5. To what extent are the behavioural characteristics of intrinsic motivation and personal orientation evident in the project members?
6. What situational characteristics are present in the innovative environment and to what extent?
7. What situational conditions are present in the innovative environment and to what extent?
8. How do collaborative partnerships with customers and business partners affect innovation?

The Case Study Report

The case study protocol should include the basic outline of the case study report. In this research the case study report is in the form of Chapters 5 and 6.

4.7.3 Pilot Study

A pilot study based on a survey questionnaire was carried out to test the initial conceptual framework. The primary objective of the pilot study was to assist in developing the protocol for the final case studies. Secondarily, the researcher attempted to identify the impact of intellectual capital on performance in a knowledge intensive environment. Since the Department of Information Systems and Computing (DISC) at Brunel University is a knowledge intensive environment, it was selected as an appropriate and convenient site. The pilot study provided an opportunity for the researcher to explore different avenues for this research and different lines of enquiry, albeit within a general research framework.

The survey questionnaire was targeted at the forty-six academic staff in the Department of Information Systems and Computing (DISC), as many of them had volunteered to answer a wide range of questions relating to the use of intellectual capital within the department. This resulted in the receipt of 19 useable replies, an encouraging response rate of 41%. In terms of the profile of the respondents, they represented a good cross section of the academic staff of professors, senior lecturers and lecturers. The feedback from the questionnaires and follow up discussions with a few academic staff highlighted the need to rethink and redefine the initial framework. It was felt that the initial framework was difficult to operationalise. The pilot study further revealed that substantive changes were needed to the content, structure and wording of the questions as well as to the data collection methods. The pilot study merely served to refocus the research effort and as such the findings of the study are regarded as not sufficiently rigorous for further analysis and publication.

As a result of the pilot study a further literature search was carried out and the researcher came across the concept of relating intellectual capital to innovation (Glynn, 1996). Glynn's model provides a theoretical basis for examining intellectual capital and it was decided to adopt this theoretical model that presents innovation as a context to examine intellectual capital factors. The pilot study also highlighted that highly structured, survey based, questions would stand in the way of getting 'rich insight'. For this reason, it was decided to use in-depth and semi-structured interviews, as well as observation instead of questionnaires to elicit information.

The study was refocused and as discussed in Chapter 3, the initial conceptual framework was developed into a comprehensive theoretical model with six key propositions and three sub propositions. Each proposition directed attention to the constructs that should be examined within the scope of the study and provided categories for organising the data. This process enabled the researcher to situate the study in a specific context and identify its boundaries as well as its limitations. The study's limitations are discussed in detail in Chapter 8.

The theoretical model and its propositions helped to determine the choice and the number of sites for fieldwork, what situations to observe, what individuals and events would be most salient to the study and what questions to ask.

4.7.4 Site Selection and Unit of Analysis

This research limited the number of cases to be included in the design, due to the time constraints of the study. A dual case design was selected, as evidence from more than one case would be more compelling when testing the propositions. This also avoids the possibility that the findings may be specific to one particular organisation. The dual case design facilitated the

selection of two deviant cases where each proposition was examined for each case and where explanation was provided to account for exceptional observations.

Choosing the appropriate sites from which to base the study is fundamental to the design of the study and serves as a guide for the researcher (Saunders *et al*, 2000). A major concern of site selection is the notion of representativeness. Yin (1994) suggests two criteria for selecting case study sites: First, through literal replication where similar results are produced and second, through theoretical replication where contradictory results are produced, but for predictable reasons. If the results turn out as predicted, these would provide compelling support for the initial set of propositions. If the results are in some way contradictory, the initial propositions would be revised and re-tested.

It was decided that knowledge intensive organisations would be most suited for the investigation of intellectual capital. According to the literature, there are two main types of knowledge intensive organisations: technology and service (Sullivan, 1998). The two organisations that were selected for the empirical investigation are engaged in high technology Research and development (ResearchCo) and in management consultancy (ConsultCo), representing the two different types of knowledge-intensive organisations. Both companies are well known in their respective fields for their innovative performance. The research focused on a comparative case analysis of the two organisations to identify major patterns of innovative performance. Through the comparison of the two cases the research was able to highlight specific features of context and how they impinge on innovation.

The study focused on two innovative projects within the two organisations as it allowed a thorough analysis of the processes, their dynamics and the underlying events. Focusing on the projects allowed the researcher to correlate innovation outcomes with innovation practices by following the projects for a number of months, thus obtaining a richer view of innovation. Focusing on the project rather than the organisation as the unit of analysis may limit the generalisability of the implications. The literature suggests that evaluation of innovations cannot be limited to the project level, since the success of an innovation may depend on how well a firm's unique competencies are integrated (Dougherty, 1996). To address this issue, this research selected two innovative projects that were strategic and cross-functional, so that they encompassed all functions of the organisation.

Information was collected about all phases of the innovative projects by tracing their development over time. Data were gathered from different perspectives. Key project members were selected as the main informants. The key project members were from different functions of

the organisation. They collaborated among themselves and with customers and alliance partners during the various stages of conceptualisation and operationalisation of the projects. Data collection is considered in detail in section 4.7.5.

Access to sites and the willing co-operation by the participants were gained through personal contacts and trust developed during the researcher's previous employment in the two organisations.

4.7.5 Data Collection

According to Mingers (2001), a research study is not a single, discrete event but a process that proceeds through a number of phases. These phases present different problems for the researcher and thus require different data-generating methods that predominate at different times.

This research employed multiple methods of data collection over a period of 18 months in which longitudinal data were collected, which included direct on-site observation, informal interviewing and reviewing documents. The researcher then went back to the two companies to interview key project members, using a formal, semi-structured interview agenda. The key project members were selected for formal interviewing for two reasons: (a) they represented all the areas within the project and (b) they were the most closely involved with the decision making processes that shaped the development of the projects.

Miles and Huberman (1994) state that collection of data over a sustained period makes them powerful for studying any process. Observation over a period of time enabled the collection of data on aspects of the research setting, for example roles played by key participants and how these changed over time, organisational structures and communication patterns. Observation also allowed the researcher to explore complex interactions in their organisational setting. The top management and the people who were observed and interviewed were informed that the researcher was conducting academic research into organisational knowledge and intellectual capital.

The trust developed between the researcher and the project members during the researcher's previous employment in the two organisations allowed the researcher to have access to rich information. For example, the researcher was able to observe the overt and covert behaviour of project members, including naturally occurring conversations. The researcher also witnessed, as a pure observer, the performance of the project committees and workshops and some of the executive committees. In addition, the researcher witnessed how the creative process was

enhanced by the exchange of ideas during the workshops. Thus, the researcher's identity could be defined as a direct observer (Yin, 1994).

Much of the documentation consisting of minutes of meetings, file notes, legal contracts and working documents of project members was accessible to the researcher. These sources, together with the accounts of participants, provided a rich picture of the innovation process. The researcher also relied on a range of secondary information such as several types of archival data.

A summary of data collection techniques and sources are presented in table 4.3 below.

Elements of data collection	Case Study One Project Team - ConsultCo	Case Study Two Project Team – ResearchCo

Sources of evidence	• Semi-structured interviews
	• Informal interviews
	• Observation
	• Documentation review
	   - minutes of meetings
	   - letters
	   - memos
	   - file notes
	   - financial records
	   - legal contracts
	   - business plan
	   - press cuttings
	   - archival data
		• Semi-structured interviews
		• Informal interviews
		• Observation
		• Documentation review
		   - minutes of meetings
		   - letters
		   - memos
		   - file notes
		   - financial records
		   - legal contracts
		   - company web-site
		   - press cuttings
		   - archival data

Informants	• Representative selection of project participants, including;
	   - Project champion
	   - key team members
	   - support staff
		• Representative selection of project participants, including;
		   - project champion
		   - Operations and sales
		   - research scientists
		   - project engineers

Interview topics	• Nature of the project • Project history • Perceptions of project performance • Perceptions of working relationships • Perceptions of sentiment • Use of collaborative mechanisms in the project activities – both internal and external • Facilitators and barriers to creativity • Exploration of significant episodes during the project life cycle	• Nature of the project • Project history • Perceptions of project performance • Perceptions of working relationships • Perceptions of sentiment • Use of collaborative mechanisms in the project activities – both internal and external • Facilitators and barriers to creativity • Exploration of significant episodes during the project life cycle

Table 4.3: Summary of data collection techniques and sources

Data collection also consisted of structured and unstructured interviewing in the two sites. The research relied on informal interviews and more formal semi-structured interviews to explore various aspects of the innovative process. Interviews allowed the researcher to have access to the interpretations that the participants have regarding the actions and events that were taking place (Walsham, 1995). The purpose of the informal discussions was to have project members reflect on their experiences of the innovative process. As both projects are currently in their commercial stage, details of the innovation were fresh in people's minds. Using these in-depth interviews with key project members as well as with a range of other informants, the research built up a picture of innovation from initiation to commercial implementation.

The semi-structured interviews addressed the constructs in the propositions and asked the respondents to provide an assessment of the relative importance of the motivational factors, enabling conditions and situational factors that impact on the innovative process. Following this, open questions relating to specific aspects of their experience were asked. The more standard questions ensured common perspectives could be captured.

Discussions revolved around a set of questions and themes derived from the theoretical model. For example, discussions were directed towards: the exploration of significant episodes during the project life cycle; facilitators and barriers to creativity; perceptions of the working relationships and the use of collaborative mechanisms in the project activities and the benefits and problems of transforming individual intelligence into organisational intelligence.

Observation, interviews and documentary evidence allowed the researcher to triangulate findings across sources and test issues of reliability and validity. The interviews built on the prior company experience of the researcher. Prior knowledge of the organisation enabled the researcher to understand the complexity of what goes on in the organisation. It was not necessary to spend a lot of valuable time in learning the context. However, the familiarity of the researcher with the situation being observed can lead to significant observer bias (Saunders et al, 2000). Saunders et al (2000) argue that this could prevent the researcher from exploring issues which would enrich the study. In order to minimise observer bias, it was important for the researcher to be conscious of and clarify her assumptions and preconceptions. Efforts were taken to minimise the observer bias by using dialogue wherever possible - informal meetings were used to discuss and clarify the researcher's assumptions and to seek various perspectives. By letting the 'field speak to you', the researcher allowed herself to 'be surprised' by her findings in the case.

Informants were project members, most of them occupying key positions within various functions. Some of the people were interviewed several times in order to clarify certain issues, study certain problems and examine certain propositions. Most of the informal discussions and in-depth unstructured interviews were carried out during the early part of the research. As the research became more focused, a more structured line of questioning was used. A limited number of formal interviews were carried out after this period to check the validity of the propositions. These interviews lasted between one and two hours. Detailed notes were made during the interviews and these were transcribed shortly afterwards. Only a few of the interviews were tape-recorded, as many people were wary of the tape recorder and it was felt that the data would be compromised. The interviews were conducted privately with only the

researcher and the informant present. The interview guide used in this research is included in Appendix A.

In total, 76 informal in-depth interviews and 11 formal and semi-structured interviews were conducted in ConsultCo. The corresponding numbers of interviews for ResearchCo are 27 and 6 respectively. It was not meaningful to ask exactly the same questions in each organisation, although the intention was to maintain the consistency between interviews. However, many questions were relevant for both organisations. The researcher first examined the propositions using data from respondents in the larger of the two samples (ConsultCo) and then used data from the smaller sample (ResearchCo) to assess the extent to which the results could be replicated. Tables 4.4 and 4.5 illustrate the nature of the interviews and the composition of interviewees in the two companies.

Organisation	Informant's Position in the Organisation	Informant's Position in the Project	Type of Interview	Number of Interviews	
				Informal	Formal
ConsultCo	Chairman	Project Champion and pioneer	Face to face	10	2
	Operations Director	Key project member	Face to face	5	1
	Strategy Development Director	Key project member	Face to face	5	1
	Finance Director	Key project member	Face to face	10	2
	Marketing Manager/ Principal Architect	Key project member	Face to face	6	1
	Administratio n Manager	Key project member	Face to face/ Telephone	20	2
	Development Support Manager	Key project member	Face to face	4	1
	Business Development Manager	Key project member	Face to face and Telephone	5	1
	Assistant Architect	Project administration	Face to face	3	-
	Marketing Administrator x 2	Project administration	Face to face	4	-
	Finance Personnel x 2	Project administration	Face to face	4	-
Total number of interviews				**76**	**11**
Average duration of interviews				Half an hour	Two hours

Table 4.4: Composition of interviews in ConsultCo

Organisation	Informant's Position in the Organisation	Informant's Position in the Project	Type of Interview	Number of Interviews	
				Informal	Formal
ResearchCo	Managing Director	Project Champion	Face to face	5	2
	Operations Director	Key project member	Face to face	5	1
	Marketing Director	Key project member	Face to face	3	1
	Chief Scientist	Key project member and pioneer	Face to face	5	1
	Customer Relations Manager	Key project member	Face to face	2	1
	Scientist x 2	Project member	Face to face	4	
	Engineer x 3	Project member	Face to face	6	
Total number of interviews				**27**	**6**
Average duration of interviews				Half an hour	One hour

Table 4.5: Composition of interviews in ResearchCo

4.7.6 Data Analysis

The overall approach of data analysis in this research was deductive, in which an orienting set of constructs directed the qualitative analysis of the data. Chapter 3 introduced and justified the constructs and their indicators that relate to each proposition. This development of a sufficiently operational set of indicators guided the data analysis and contributed towards the high construct validity. The use of multiple sources of evidence in a manner that encouraged convergent lines of enquiry further strengthened the data analysis and construct validity. The constructs suggested several categories that served to organise the data initially for subsequent analysis.

According to Huberman and Miles (1998), deductive designs are appropriate when the researcher has prior familiarity with the setting, has a good bank of applicable, well-delineated concepts and takes an explanatory stance involving comparable cases. Although initial concepts and propositions guided the researcher, the emphasis was shifted and modified as data analysis progressed. Therefore the analytical strategy was more interpretive and subjectivist (Walsham, 1995) where the facts and values were intertwined and hard to disentangle.

Saunders et al (2000) assert that there are a number of implications of using a deductive analytical strategy for conducting a qualitative analysis:

- The researcher is in a position to commence data collection with a clear framework and propositions derived from the theory;

- The researcher is in a position to identify the number and type of organisations to gain access to, in order to collect data to meet the research objectives;

- The use of theory and propositions within it will shape the data collection questions;

- The researcher is able to start the data collection with an initial set of categories derived from the theoretical propositions;

- The above strategy provides the researcher with key themes and patterns to search for in the data;

- Attaching units of data to categories and examining these for emergent patterns will be guided by the propositions and explanations the researcher started with at the outset of the study;

- Seeking alternative explanation and negative examples that do not conform to the association being tested for, will enable the researcher to test the propositions with rigour.

However, the use of predicted explanations may mean that the pathway to an answer to the research question is a more defined one.

4.7.7 Methodological Rigour

Building rigour into the research design is an issue, which the researcher should respond to. This will involve addressing issues such as construct validity, internal validity, external validity and reliability. In chapter 3, the researcher established and justified the operational indicators for the concepts being studied, contributing to construct validity. Construct validity is further supported in this research by using multiple sources of evidence in a way that encouraged convergent lines of enquiry as described in previous sections. Furthermore, a case study database was created and maintained in which research notes and records were kept in a retrievable form. External validity was established by employing an explanation building approach during data analysis. External validity also involves establishing the domain to which a study's findings can be generalised. This was achieved by using a dual case study approach in which replication logic was employed. In addition this research provides for "analytic" generalisation (Yin, 1994), where a previously developed theory is used with which to compare the empirical results of the study. Reliability is demonstrated by the appropriate use of case study protocol in this research as detailed in section 4.7.2.

4.8 Conclusions

This chapter has argued that developing an appropriate research methodology as part of the research activity is of critical importance to the communication of research findings. A clearly justified methodology not only gives rise to new insights that are backed by appropriate evidence but helps others judge the value of the research findings. The chapter reviewed a number of philosophical foundations that are widely used in social science research and justified the research strategy chosen in relation to other strategies, focusing on their different epistemological stances. The empirical investigation of *how* IC factors impact on organisational value creation required the researcher to understand the fuzzy, ill-structured world of complex organisations. Understanding the complex social interactions that involved multiple perspectives and contextualised meanings strongly suggests a qualitative approach. In order to capture the richness and depth required, this research adopts an interpretative and subjective stance.

This chapter has demonstrated the case study approach as the most appropriate research strategy for this study. In particular, case study was justified as an environment for testing theory in order to examine the validity of the propositions proposed in Chapter 3. The prior development of theoretical propositions further strengthened the case study approach by providing a guide for data collection and analysis. The chapter also highlighted four major weaknesses of case study research. In order to alleviate each one of these criticisms, this research has developed a methodologically sound and rigorous research design, from defining the initial set of research questions, through the collection and analysis of relevant data to presenting a set of research conclusions. Such a design provides a framework for describing the phases, activities and the flow of the research process. The quality of the design is addressed through the four tests of construct validity, internal validity, external validity and reliability.

Fundamental to the design of the study was the selection of appropriate sites from which to base the study. It was reported that a major concern of site selection is the notion of representativeness. This research limited the number of cases to be included in the design due to the time constraints of the study. A dual case design was selected, as evidence from more than one case would be more compelling when testing the propositions. Two deviant companies were selected as detailed in sub-section 4.7.4. This sub-section also provided reasons for focusing on two innovative projects that were strategic and cross-functional, as the unit of analysis. A number of aids were used for the process of qualitative analysis, including interviews, observation, documents, and maintaining a researcher's diary. These data generating

methods predominated at different times. The overall approach for data analysis in this research was deductive, in which an orienting set of constructs directed the qualitative analysis of data.

In the next two chapters (5 and 6), the collected data will be described and presented in the form of research findings.

Case Study One – Research Findings

5.1 Introduction

This chapter and the next (chapter 6) provide the empirical exploration of the role of intellectual capital (IC) in value creation in two innovative settings. The aims of this chapter are twofold. Firstly, to examine the propositions defined *a priori* to the field study, in relation to the findings of the empirical investigation. Secondly to explore the mechanisms by which intellectual capital factors contributed to value creation. In testing the propositions of the research model, it is not the intention of this empirical investigation to describe the stages of the innovation process, but rather to examine the role of intellectual capital in the context of innovation. The empirical study focuses on the interactions among the dimensions of intellectual capital rather than attempting to establish causality.

Two organisations have been selected to provide direct empirical tests of this model, in which two types of innovative projects have been examined. The two organisations are similar in terms of the knowledge intensive nature of their operations. However they tend to differ in innovation orientation. Study one is based on new business creation whereas study two focuses on technology innovation, hence allowing the investigation in diverse settings. Furthermore, study one is in the low-technology property sector, whereas study two is in the high-technology multimedia sector.

The particular projects were chosen for their focus on knowledge and for their records of innovation. The project in study one reflects incremental innovation as the project was based on the existing service experience of the organisation. The project in study two reflects radical innovation, as the technology was entirely new to the organisation and the industry. The names of companies and their projects, the details about organisational members and the specific dates are not disclosed at the request of the companies in order to preserve confidentiality.

This chapter presents the findings from case study one, ConsultCo. The chapter is divided into five main sections. First, section 5.2 describes the context of ConsultCo in terms of the company background, its activities and markets, human resources and collaborative partnerships. The next section 5.3 presents a description of the project. Section 5.4 and its sub sections are devoted to examining each proposition that is organised in relation to the dimensions of intellectual capital – human, structural and relational. Section 5.5 then reviews the mechanisms by which IC factors contributed to value creation. Section 5.6 assesses the extent to which the project created value for ConsultCo. Finally, the chapter concludes with a summary providing an overview of the chapter.

The findings from the second case study, ResearchCo are presented in chapter 6.

5.2 The Context

This section provides the contextual information of the first case study of this research and outlines its background, activities, markets, human resources and collaborative partnerships. The context is described from an intellectual capital perspective.

5.2.1 Company Background

ConsultCo is a wholly owned subsidiary of a small and medium sized enterprise (SME)[1] engaged in management consultancy and property development. Formed in 1989 for the purpose of undertaking developments within the health sector, ConsultCo have been instrumental in the pioneering of non-core services development such as hospital concourses and private-patient units in several of the country's general hospitals. These developments are carried out in strategic joint venture partnerships with Health Authorities and the NHS and generate revenue for the NHS that can be used to fund vital clinical facilities.

The privately owned company has an annual sales turnover of around £8m and a human resource base of approximately 45 employees of which over 90% are professional workers. ConsultCo's core asset is the knowledge of its employees and its core product is the business knowledge itself. The company operates in a dynamic marketplace where innovative service is the key to competitive advantage.

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[1] A company classified as an SME has fewer than 250 employees and an annual sales turnover not exceeding 50 million Euro or an annual balance sheet total not exceeding 43 million Euro.

In the late 1980's, through a series of educational workshops, the company sought to demonstrate its commitment to best value and broadened the understanding within the NHS of the potential benefits of an 'entrepreneurial spirit' in the NHS environment. The feasibility of creating commercial units within hospital precincts was thoroughly researched by ConsultCo. A press release issued by the company describes the origin of the initial idea:

"The Chairman began to focus on the idea of allowing NHS Trust hospitals to concentrate on matters pertaining to the clinical needs of its patients, leaving the development and long-term management of non-core services to the private sector".

Thus the strategic intent of developing non-core services for the healthcare sector guided the company's actions that evolved over time. The key challenge for ConsultCo's management was to develop and implement programmes to translate this vision into reality. They achieved this by using the company's intellectual capital – their knowledge, experience, expertise and associated intangible assets.

ConsultCo's flagship development of a concourse with retail facilities in a prestigious teaching hospital in the north of England was the first of its type in the country. It was completed in 1995. According to an article in the trades press:

"The original approach came from ConsultCo who recognised an opportunity for the Trust to maximise their resources while minimising risk. ConsultCo's management team envisioned the benefit of such a concept for the NHS, the patients and clinicians as well as for the private investor, creating value for all parties. The development also provided valuable learning experience for the company and the NHS, which has since become a precedent for future developments within the NHS".

The director of developments at the NHS Trust commented on the project:

"The initiative was a ground-breaking project and we are extremely pleased with the outcome. The new scheme has done a lot to enhance the hospital and provide improvements for patients and staff. The business arrangements are working well and benefiting the retailers and patient care at the hospital".

The project resulted in everyone involved gaining valuable knowledge about the practicalities of developments within the NHS. Subsequent completed projects have enhanced the company's

blueprint formula as to the best way of implementing a health-sector development from start to finish.

5.2.2 Activities and Markets

Given the team's expertise in the healthcare sector and against the backdrop of retail developments, the company has extended its focus into the design and development of a portfolio of primary and intermediate care resource centres. Working alongside health authorities, Primary Care Trusts, General Practitioners and other health practitioners such as physiotherapy, community nursing and midwifery, the company has created new models for primary care clinical service provision. Applying the unique insights gained into combining social interests with commercial interests, ConsultCo is currently developing two of the largest Primary Care Resource Centres being planned in this country, operating as the principal developer and funder. The company is now looking into moving beyond the traditional development of healthcare premises to incorporate initiatives that improve the ICT infrastructure to transcend the existing organisational boundaries of the NHS. Thus the company can be described as innovative, as it frequently cycles through the process of developing innovative services and processes.

Many of ConsultCo's projects are carried out within the parameters of the public/private partnership (PPP). The principle of PPP introduces private capital and expertise to public services. Private sector partners are invited to present solutions, finance the capital costs and take on the responsibility for maintaining and managing the non-clinical services. In a published article, the Minister for Health expressed the importance of modernising and reforming the NHS in order to improve the health and wellbeing of the local populations:

> "Our public infrastructure is dangerously run down.... In an age of tight public spending, value for money public/private partnerships will be at the heart of a much needed renewal of our public services".

However, the PPP initiative has many critics. The unions are concerned that value for money will come at the expense of staff terms and conditions. The local government officials are overwhelmed by the legal and technical complexities that strategic partnerships with the private sector introduce. The public is suspicious that change in the NHS is really about cutting services. The most serious objections to the PPP initiative have been due to the suspicions of the operational strategies of the private sector partners. These critics question how private sector partners can deliver major public infrastructure projects more efficiently and effectively than the government when it costs them more to borrow. A recent study by the Treasury lays to rest

these arguments and shows that private sector financed government projects have a clear lead over conventional government led projects in delivering on time and to budget and that profit orientation and attention to quality are not mutually incompatible.

5.2.3 Human Resources

ConsultCo's small, flat organisation has a human resource base that comprises of a high number of professionals and a very few non-professional but highly skilled employees. The activities of ConsultCo's employees are focused on a highly purposed problem solving process. Most projects undertaken by ConsultCo span several functions, requiring the close co-operation of cross-functional work teams from the various functions of legal, finance, design and architecture, strategy development, marketing and administration. The various functional groups within the company operate as self managed work teams. Due to the small size of the company, communication between members is informal and face-to-face. Members simultaneously work on more than one project, allocating time according to the order of priority. The knowledge, skills and experience of ConsultCo's employees are vital for the survival and growth of the organisation.

The chairman of ConsultCo heads the management team and directs the company's business policy. A charismatic leader with vision, energy and a strong desire to succeed, he generates commitment and loyalty within all levels of the company. The top managers are functional specialists who have the task of agreeing goals and milestones for the activities within their functions. The top managers also act as key project members. They assume entrepreneurial roles and are required to continue the process of innovation, in which they proactively seek to create opportunities or solve problems to serve business needs. The key project members affect the performance of the project at two levels. Firstly they influence the day-to-day operations of the project. This ensures the effectiveness of the resulting activities and processes that produce the innovative output of the project. Secondly, they work to interconnect the activities that drive value creation by working closely with their alliance partners.

The intellectual activities of the project members involve conceptualisation of the needs of the customer and other stakeholders, articulation and resolution of various viewpoints, development of shared understanding, selection and rejection of various options and the reasoning and deliberation employed to carry out these activities. The company encouraged diversity in individuals' approaches to problem solving and creativity. As the project members approached problem solving from different perspectives, conflict was inevitable at most times. However, these conflicting ideas enhanced the creative potential of the group by creating something that no single perspective could achieve.

5.2.4 Collaborative Partnerships

ConsultCo's management recognises that collaborative partnerships constitute a critical capability through which greater performance effectiveness can be achieved and that they need to be appropriately managed and nurtured for successful business partnerships. Each project is co-ordinated by a collaborative team of professionals with expertise in the fields of specialist health care strategy development, project management, property development, design and construction as well as in services such as catering and retail. This co-ordination is achieved by drawing on communication, co-operation and learning-oriented working relationships. A major strength of the company has been its ability to build and nurture successful relationships with suppliers, customers and other stakeholders. For example, in addition to the existing long-term business partnerships, the company has a strategy of involving local stakeholders in the schemes so that the projects benefit from their knowledge of specific local conditions, requirements and expectations.

The next section presents the project, which is viewed and described through the lens of value creation.

5.3 The Project

The project described in this research is one of the company's smaller developments that has recently been completed, thus enabling the researcher to follow the process from its inception to completion. The project is a development of a concourse with retail and catering facilities within a district hospital in England. Although similar to the company's first landmark initiative, this project incorporates many new ideas as well as benefiting from the valuable learning experience from the many previous projects. For this reason the project is based on and represents an incremental innovation of the previous developments.

The project was led by ConsultCo's business development director and championed by its chairman. At the start of the project, an official team was formed with 8 key members drawn from several functions, which covered a wide cross-section of the organisation. Their expertise in relation to the health sector ranged from strategy development, marketing, design, architecture, legal and finance. Drawing on the company's network of business partners, ConsultCo appointed several alliance partners. Most partners have been working with ConsultCo on similar projects.

5.3.1 The Project Proposal – Creating Value through New Service

The project was initiated in January 2000 with the submission of a bid proposal to the NHS Trust in response to an Invitation to Negotiate (ITN). The proposal outlined the technical

feasibility and ConsultCo's experiences and competence to provide solutions that met the Trust's needs for (in the Trust's own words), a 'main entrance/reception - [Year] 2000 and beyond'. The reception area of the district hospital has not been modernised since the hospital first opened, in the 1970s.

The capital cost of the project is £1.3 million with an estimated annual income of £250,000. Over £3 million will be received by the NHS Trust over the period of the partnership which spans twenty-five years. This is obtained through a ground rent paid to the NHS Trust by ConsultCo and a percentage of profits achieved by the retail tenants over a minimum guaranteed income. ConsultCo's innovativeness was primarily demonstrated in their expertise in devising the funding structure for the development. The company had reviewed its method of operation in relation to retail centre development within hospitals and had structured a new formula that ensures a substantial annual income to the Trust. The company would still fund and manage developments in their entirety, but shares excess profits with the customer. The rigorous proposal to the NHS Trust consisted of a financial model of costs and benefits, a profile of the guaranteed benefits stream and a risk management plan. These items were defined over the life cycle of the project that spanned twenty-five years. In addition to presenting the initial business case, the proposal also set out the basis for the delivery of benefits. Further clarification of the financial and legal formulae were discussed before the works began and the principles of the accounting treatment have been agreed with the Trust's external auditors. The project had substantial support from the Trust because of the benefits to the Trust and from ConsultCo's senior management because of its fit with the company's strategy of improving its reputation and value. The Chairman of ConsultCo states:

> "Our main aim is to facilitate the creation of hospital retail centres with obvious benefits to the hospital. All profits after finance and management costs generated by the retail centre would be directed back to the hospital. The bulk of the profit income generated therefore, would be for the benefit of the Trust".

The customer reinforces this sentiment. For the NHS Trust, the project offered several benefits as set out in the minutes of The Trust's Board meeting to approve the project and appoint ConsultCo as the preferred partner:

- An improved entrance environment;
- A selection of retail amenities for the convenience of staff, visitors and patients, managed by an experienced professional company;

- The refurbishment, improved access and retail amenities will benefit patients and staff;

- A guaranteed stream of future income;

- The guaranteed income to the Trust is without risk;

- The cost to the NHS/Trust is nil;

- There are many precedents for a development like this in other hospitals, as ConsultCo has carried out similar successful developments at several similar hospital sites.

5.3.2 Creating Value through Customer Focus

The collaborative team members got together to analyse the many courses of action open to them in fulfilling the customer's requirements, objectives and issues based on the information that was provided (as detailed in Appendix D). Since these specifications were defined in broad terms, many clarifications had to be sought. The elements that were crucial here were the sensitivity to customer's requirements and knowing how to uncover the customer's real needs and then translating this knowledge into action.

As with any project in the health sector, the project had many stakeholders such as the health authority, the local authority, the Trust, staff, patients, visitors, unions, existing retail tenants for the staff shop and the convenience store and the various charities involved with the hospital. Many informal meetings were set up in parallel with each group of stakeholder to discuss and detail the existing work patterns, requirements, expectations and concerns as well as to create awareness of the initial project plan. Through several iterations of this process the team discovered the project's critical requirements and the initial problems that needed to be overcome in order to adequately cover the design, technical and contractual procedures. The problems needed to be resolved ranged from the concerns of the existing tea-bar and staff shop about the competitive products of the new retailers through disability access and way finding, to fire resistance and acoustic performance. The team solved these problems by coming up with innovative solutions. An early meeting with the local planning officer highlighted more technical issues, but showed a positive response to the redevelopment and extension at the hospital as provided in the project plan.

There were many meetings among the project team in which the various plans for design, communication, implementation, presentations (to stakeholders) and construction were put in place together with procedures for issues requiring resolution such as security and health and safety. In parallel continuous negotiations were taking place with both the customer as well as the prospective retail tenants and other contractors regarding pricing structures, lease agreements, positioning of the retail units and even the sale of products that are not directly in

competition with each other. Necessary documentation was prepared covering all aspects of the project including detailed design drawings, legal contracts, cost estimates, cash flows, budgets, timetables and milestones. The project's overall objective of '[Year] 2000 and beyond' served as a guideline for the team's discussions and actions throughout the planning, design and construction phases, as evident from the long-term focus and the built in flexibility of many aspects.

The team gradually combined and incorporated the tacit knowledge of its members and the needs of the stakeholders into the project's unique features. At the same time, the team learned new things by attending to the customer's issues. Thus the customer contributed to the company's knowledge base.

5.3.3 Creating Value through Superior Service Delivery

Following the initial planning and design, the construction work began on site in January 2002. The development of the concourse encompassed redesigning dedicated ambulance drop-off bays and waiting areas for outpatient clinics and is designed to relieve congestion in the area by easing the access for patients, visitors and staff. It provides a convenience store and eating facilities along with a range of other retail outlets. The overall environmental effect is a more welcoming entrance for patients arriving at the hospital including a new spacious lobby and lighting scheme with new signage. The central space is a new 'social heart' for hospital staff and patients alike. One of the spectacular features of the extension to the building is its marquee-inspired structure. The extra roof height achieved is in contrast to the low ceiling level consistent throughout the hospital and provides a welcome relief, with natural daylight and views and access to the courtyards. This space also provides a backdrop for works of art designed by the hospital's 'Art in Hospital' programme. The new courtyards are intensively landscaped and serve as child play areas and as a sculpture court. These will be used by patients and staff and replace the existing large courtyards with no access. The catalyst for this redevelopment and the creation of the new 'social heart' for staff and patients are the retail facilities. The retail units are placed in the spaces available without interrupting the hospital reception, circulation and seating spaces.

The employees welcome the opportunity of having retail shops and a foodcourt on their doorstep as irregular working hours and limited breaks often prevent them from venturing out to the town centre or the local shops. The development is equally appreciated by visitors and patients, who can make gift or emergency purchases, browse during waiting periods or relax over a cup of coffee and freshly baked pastry.

5.3.4 Creating Value through Co-operation and Collaboration

As the construction work on the development scheme was carried out while the hospital remained fully operational, the project team worked collaboratively to execute complex work sequences in order to prevent any disturbance to the smooth running of the hospital. The Chief Executive of the Health Services NHS Trust says of the hospital development:

"The construction project at the hospital is vital to improve the quality of care and facilities that we provide for our patients. However, it is equally important that the quality of care is not reduced while the project is in progress. ConsultCo is working very closely with the hospital, making the utmost effort to ensure that the health services that we provide are unaffected".

ConsultCo's design and marketing manager commented:

"Working with the hospital, the team carefully planned and organised the building work devising a complex project management scheme to ensure there was no disruption to the patient-flow through".

ConsultCo and the NHS Trust worked together as a partnership throughout all the stages of the development and in the careful selection of retail tenants for the various units, chosen for their value to patients and staff at the hospital. It is also the policy of ConsultCo to commit to fund substantial maintenance of the concourse at fixed points in the contract, with the hospital undertaking the day-to day maintenance.

All activities within the project were based on collaborative principles agreed prior to undertaking the project. These activities included, design, construction, project management, quantity surveying, cost control and engineering services. ConsultCo's team was responsible for the project management, co-ordination, value management, design management, design workshops, risk management and management information.

The project was successfully completed in June 2003. However, there were many challenges that the project team had to overcome, as described below.

5.3.5 Challenges faced by the project team

Healthcare is, arguably, a highly dynamic sector that is currently undergoing an 'innovation shift' from traditional to non-traditional modes of operation. Working within continuously changing legislation and driven by the need to comply with current EU directives, ConsultCo

needed to build in operational and financial flexibility to its development model. Such environmental changes increased the uncertainty in data and risk and if not for the meticulous planning and co-ordination, could potentially have thrown the project completely off course.

Bidding for public sector contracts can be costly and highly risky. The company devoted significant effort to working out agreements on an effective joint-venture structure in relation to the long-term viability of the project. The initial pre-contract front-end costs associated with project conceptualisation, pre-feasibility studies, proposal development and drafting and signing of contracts as well as drafting legal provisions that specify commitments of collaborative partners added to over £250,000 amounting to nearly 20% of the total costs.

The selection procedure for the preferred partner was long drawn out, involving nearly eighteen months of intense and at times frustrating negotiations. The time lag between the initial capital costs and commercial returns can take up to three years.

In the negotiation of contracts from the preferred partner status up to the financial close, the project involved nearly 40 different legal contracts covering funding, construction and leases with the Trust and retail tenants, making the project highly complex.

Although the project was embarked on for its profitability after carefully evaluating the risk versus return relationship, the perpetual innovation in the industry and rapidly increasing competition frequently negate any advantages that seem to be secure.

The depth and complexity of government regulation was overwhelming. The bureaucratic nature of the operations in the public sector institutions such as the local authorities and regional health authorities meant that there were many delays in the decision making process, adding to the project's costs.

The diversity within the collaborative team meant that there were conflicting views needing intense negotiation and understanding of each other's value and striving for win-win scenarios. However, this diversity also exposed the organisation to different perspectives, thereby increasing its learning and experiential knowledge.

The success of any project depends on the development of innovative, practical solutions to the many requirements of the customer and the end users. However, customers were not always able to set out clear requirement specifications, so that they could be properly quantified in order to provide a meaningful and competitive response. ConsultCo's "extensive knowledge of

the healthcare sector" [strategic development director] and "the genuine willingness to provide more than strictly necessary to help the customer achieve their goals and objectives" [operations director] were factors that created competitive advantage for the company in being awarded the contract.

Having provided a description of the organisational background and the project, the next section and its sub-sections are concerned with discussing the findings from case study one in light of the data gathered and in line with the propositions as described in chapter 3 (section 3.5).

5.4 Examining the Propositions

In the following sub-sections the project is reviewed in terms of the propositions of the theoretical model to provide insights into how intellectual capital factors contributed to value creation. Since the strengths of qualitative data depend mainly on the competence with which their analysis is carried out, efforts were taken to build a coherent interpretation of the data as described below.

The overall approach of data analysis in this research was deductive, in which the researcher started with an orienting set of propositions, which directed the qualitative analysis of the data. Data were organised around the constructs from the propositions in order to provide an interpretation of particular events. Interview notes, observation notes and company documents were thoroughly read and re-read, looking for concepts, themes and patterns that fell into the established categories. For the purpose of examining the propositions, it was decided to interview the 8 key project members who were considered to have a rich understanding of the company and the project. A semi-structured interview schedule was used for the formal interviews. Several informal interviews were conducted to clarify issues, both with the key project team and with others who were involved in the project. Interviews were systematically compared in order to identify different explanations for similar events. Critical passages in the data were highlighted and categorised and the researcher's interpretations were recorded in marginal notes. Case data was continuously matched and contrasted with theoretical interpretations to see how they fit with the propositions. During this process the researcher also came across serendipitous findings that generated new insights. These are described in detail in the Conclusions section at the end of this chapter.

As described in Chapter 3 (section 3.5), each proposition relates to aspects of human capital, organisational capital and relationship capital, which are the key ingredients of organisational value. Examining the project in light of the propositions helped the researcher to understand the extent of the key ingredients that were present and how they contributed to value creation. By

confronting each proposition with practice, the researcher ensured that the data gathered gave sufficient information for refutations and conjecture.

Sub-sections 5.4.1 to 5.4.3 discuss the outcomes for propositions 1 to 6 and their indicators as justified in Chapter 3 (section 3.5). The case evidence is then presented by way of a tabulated summary of outcomes for each indicator in tables 5.1 to 5.6. As indicated in the tables, each outcome is supported by a combination of project and company documents, project members' own interpretations of events and processes and the field notes made from the researcher's observations.

Sub-section 5.4.4 provides an overview of the outcomes relating to the propositions. In order to illustrate the relative contribution each construct made to the value creating process, a 5-point Likert type scale was used where the strength of the evidence was rated from very weak to very strong. Table 5.7 sets out the 5-point scale and table 5.8 summarises the strength of evidence relating to each construct.

5.4.1 Examination of Propositions Relating to Human Capital

Human capital refers to the quality of work denoted by the knowledge, creativity and motivation of the worker (Walberg, 1988). This sub-section examines these factors in terms of the three main propositions and three sub-propositions that relate to the intellectual human capital. The three main propositions investigate the types of knowledge, levels of knowledge and creativity, while the three sub-propositions are concerned with the antecedents of creativity.

Proposition 1 - Types of Intelligence

There are two main types of intelligence that are associated with the innovation process. They are (a) technical knowledge that is relevant to the task or problem, and (b) social, political and interpersonal knowledge that is specific to the organisational context.

Both types of knowledge are characterised by procedural knowledge (know-how) that enables the combination and recombination of declarative knowledge (know-what).

Technical Knowledge (Domain relevant knowledge)

The initial interviews ascertained that the key project team at ConsultCo consists of 8 members from the various functions within the organisation, with each function covering a component of the project. Each key project member that was interviewed was asked to give a brief overview of the nature of their education, the number of years they have spent in the industry sector and in the company. They were then asked about their special skills and expertise. These initial questions in the interview agenda allowed the researcher to assess the knowledge intensity of

the team and produced many descriptions of the way members utilised their knowledge and skills as the primary source of the company's innovativeness.

All the interviewees have a degree level education and have professional qualifications in their respective areas. By belonging to a professional body, members undergo rigorous testing and accepting procedures, ensuring that members are competent. This competence represents the potential to create value. The interviewees have a total of 96 years of experience within the health care sector, with a minimum of 3 and a maximum of 20 years. The key project team has spent an average of 6 years in the company. The composition of the key project team consists of 1 female and 7 male members. Of the eight key project members, four have healthcare service related expertise, five have financial expertise, two have legal expertise, while two members specialise in the NHS strategy development consultancy. There is further evidence in the company's business plan, which discloses that the members specialise in the areas of legal, finance, marketing, design, strategy-development and healthcare service development. In addition, the researcher was able to ascertain from the company documentation that the mean age of the key members is 46.9 years, with a minimum of 30 and a maximum of 60 years.

The age and the experience of the members indicate the depth and breadth of knowledge available within the company. The experiences of the individuals have enhanced the quality of the business solutions offered by the company. This was achieved by a better understanding of the business environment, gained through experiential learning. Experience also helps to create new deeper knowledge, which in turn leads to qualitatively better service. The team's formally educated specialisation in the various disciplines combined with the healthcare relevant experience has resulted in industry specific expertise and the availability of deep knowledge to apply to problems. It was evident that ConsultCo's technical knowledge consists of the expertise embedded in people and forms the basis of their competencies and know-how. Several operational experiences indicate that the company has captured some of the value of this knowledge and the ideas it generated. For instance, ConsultCo's competitiveness is derived from their expertise to conceptualise the customers' abstract requirements and their ability to provide customised solutions. As described previously, the company has successfully completed the first PPP project in Britain and set precedents for future NHS projects of this kind.

As will be described below the set of technical skills possessed by the employees represents a necessary but not sufficient condition for value creation. However, the synergy from the unique combinations of the members' expertise created strategic capabilities that were needed for value

creation. These capabilities are neither readily transferred nor imitated by its competitors, thus providing strategic advantage.

Social, Political and Interpersonal Knowledge (Context specific knowledge)

An examination of each interviewee's role in relation to the project team as a whole revealed that the key project members maintained overall control of the project and accountability to the customer.

At ConsultCo, it was apparent that domain specific knowledge in itself was neither useful nor important in the value creating process. For instance, during the interviews, all key project members indicated that the success of their knowledge-intensive work was contingent upon forming and maintaining inter-personal relationships with the other project members, the customer and other stakeholders. The nature of these working relationships were variously described as "outlining the objectives and agreeing on milestones amongst the project members" [administration manager], "demonstrating our ability to take on board the customer's unique requirements" [the chairman], "clarifying expectations" [business development director] and "negotiating agreement to solutions" [marketing/design manager].

The researcher's observations and documentary evidence confirm that in addition to managing the internal relationships within the organisation, the key project team was involved in the complex activity of co-ordinating a host of relationships with external business partners, customers and other related stakeholders. These responsibilities demanded the possession of social and political influence as well as interpersonal understanding in order to get the buy-in from others to their ideas and suggestions, because a clear lack of buy-in would affect the outcome of the project adversely. For example, the numerous correspondence in the 'Retail Tenants' file highlights the extent of the argument and persuasion that was employed in the selection of retail tenants who would be located in the hospital concourse. A decision such as the selection of retail tenants required negotiations with the NHS Trust, existing tenants, hospital staff representatives, specialist estate agents as well as the in-house finance specialist. The agreement of various stakeholders was needed to ensure that a prospective tenant, was not in the list of hospital's prohibited trades such as undertakers, solicitors or alternative therapists; did not pose a competitive threat to existing tenants; ensured provision of staff benefits; and be a blue chip retailer with financial credibility.

Furthermore, the key project members, with a better understanding of the company's and the project's objectives, acted to foster goal congruence among the collaborative partners and to keep the project on track. This was achieved through a series of monthly project steering group

meetings and the associated meetings for specialist tasks that were specifically designed for this purpose.

The above examples illustrate that the social, political and inter-personal skills are linked to value creation through its contribution to the successful outcome of the project.

Procedural knowledge

The project team continuously challenged and tested the assumptions underlying the processes and expected outcomes. This ability to combine existing factual (declarative) knowledge about a given area with problem-solving (procedural) knowledge to provide situation-specific solutions to problems was evident in the correspondence relating to a project review meeting in which the team members discussed improvements to the architectural designs. These designs were later hailed as a major contributor for the quality of the new environment and were praised in several articles in the press:

> "The standard, the concept and the detail you describe will, when implemented, give the quality needed for this operational environment. However, we think that what we have seen to date is conceptual and lacks the detail that we will all need to see before the final design can be agreed. We feel it would be helpful to list the detailed design items and some of the points raised at the previous review meeting, as follows........."

Thus the project participants used their past knowledge of the operational impact of the architectural design in order to ensure the required functionality. As a result, a number of original designs were reworked.

The above example also demonstrates that innovation at ConsultCo was an iterative process, which was facilitated by the sharing of tacit knowledge within a group of people. When asked to elaborate on how the problem-solving knowledge was put to use to be competitive or to create value for the organisation, the operations director explained:

> "You need previous experience in order to understand the parameters. Having experience of similar projects also helped us to see what would work best in a particular environment".

It appears that the domain specific (factual) knowledge influenced the quality of the problem identification at the many stages of the project, while the tacit knowledge improved the team's problem solving performance by helping them to 'see what would work'.

It was not just the team's existing knowledge and experiences of the field that contributed to results, but also its ability to explore new and different ways of doing things. This ability was displayed throughout the project but specifically, at the proposal stage when the team proposed innovative solutions to the Trust's requirements specification as noted in the minutes of a board meeting at the Trust.

"ConsultCo were selected for their imaginative proposal, their superior financial contribution to the Trust with no Trust risk to capital and a guaranteed stream of income during the lease period".

The above examples illustrate that the team used the existing factual knowledge to address the issues and the tacit procedural knowledge to resolve the issues in a logical and consistent manner.

In summary, the examination of proposition 1 reveals that the key project members possessed a high degree of professional knowledge and skill in their respective fields. The members also highlighted the importance of inter personal knowledge in the effective participation of team work, with people inside and outside the organisation. The researcher's observations show that the members displayed a knowledge spectrum that varied in intensity from technical proficiency to interpersonal skills. For example, in some areas such as finance, tax and architecture, considerable command of technical proficiency was required, while in other areas such as strategy development, design and marketing, interpersonal skills were much more prominent. Furthermore, the knowledge spectrum was visible within the individual as well as across individuals. The team's skilful combination of both types of knowledge with problem-solving procedural knowledge provided superior customer perceived value.

Table 5.1 presents the summary of case evidence relating to the indicators of proposition 1, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Technical knowledge (Domain relevant knowledge)	• Professional education	Particular expertise in specific fields such as finance, legal and strategic planning	Documents, interviews
	• Number of years in the industry and the company	Ability to conceptualise the customers' abstract requirements	Documents, interviews
	• Special skills	Provision of intellectually robust advice	Documents, interviews
Social, political and interpersonal knowledge (Knowledge about the organisational and industry context)	• Level of involvement in the project	Involvement in the project at a high level Social and political influence	Documents, observation, interviews
	• Personal characteristics	Active use of interpersonal relationships to get 'buy in' to ideas and to foster goal congruence	Documents, observation
Combination of procedural knowledge (know-how) with declarative knowledge (know-what)	• An individual's experience	Practical experience-based knowledge	Documents, interviews
	• Intellectual skills of knowing how to do something	Tacit skills to explore new and different ways of doing things.	Documents, interviews

Table 5.1: Summary of Evidence Relating to Types of Intelligence in Proposition 1

Next, proposition 2 is examined in respect of the levels of knowledge.

Proposition 2 - Levels of Intelligence

There are two main levels of intelligence that affect the innovation process. They are (a) individual intelligence that is domain specific and (b) organisational intelligence that is context specific.

Intelligence at the individual level

As described previously, the individual knowledge within the organisation resulted from the education, expertise and experience of each project member. According to curricula vitae of the members, the key team members have a history of distinguishing themselves through individual achievement. Their individual knowledge contributed to the value creating process by both designing innovative solutions and seeing them through the implementation process. When asked to comment on the expertise of the team members, five (of the eight) interviewees said that the team has industry recognised unique expertise, while three interviewees disputed the

'uniqueness' of this expertise. Interestingly, the latter three were the individuals perceived as 'unique industry experts' by their colleagues as well as the customers (e.g. The NHS Trust). Various project documents recognised the value adding input of the members, which range from designing a new legal structure for the tenants' lease agreements, to innovative investment plans backed up by substantiated evidence of viability.

The individuals' technical/professional knowledge and its practical counterpart, skills, formed the basis of ConsultCo's distinctive competencies and represented the company's innermost potential. However, it was evident that members tend to hold knowledge tacitly in their heads rather than on paper or in databases. The project members voiced a Polanyian (1966) view that it was not possible to express all of their knowledge in words. Moreover, the tacit nature of the individual knowledge meant that it was seen as a property of the individuals exclusively, rather than belonging to the company. In this situation, personnel turnover or lapse of time could wipe out the company's memory.

ConsultCo has put in place several processes to minimise the adverse effects of individual tacit knowledge. For example, as discussed below, the company encouraged the development of close working relationships among the members so that the inarticulable tacit knowledge is held collectively by providing the opportunity for imitative and apprenticeship learning. The company also encouraged the retention of employees through participative management practices and generous reward and incentive schemes, as described under organisational capital.

Intelligence at the organisational (collective) level

Interviews revealed that on average, key project members have been employed at the company for 6 years, with a minimum of 3 and a maximum of 14 years. This represents the extent of the shared team experience held by organisational members. All interviewees agreed that the company's stock of skills evolved over the years from its past achievements.

Most of the tasks were unique to the project and therefore unstructured. To develop solutions to such unstructured tasks required drawing on skills based on both individual and collective knowledge. It was apparent that the cross-functional membership of the team provided multiple disciplines and expert knowledge of the respective processes required for the successful completion of the project. For example, the architectural team needed to incorporate the various redesigning of the existing work processes (i.e. sign posting, touch-screen information to patients, repositioning of offices) that were carried out by the strategic team. The strategic team in turn needed to take into account the legal and ethical complexities (i.e. employee rights,

disability access, and security measures) that needed to be resolved by the legal team. ConsultCo's development-support manager comments:

"We are aware that problem solving that characterises this company cannot be achieved by any one person. It requires insights from many perspectives. We find solutions by building on one another's ideas".

Thus, ConsultCo's collective knowledge was generated in interactions between members with diverse viewpoints. It appears that the members are aware that the fundamental rationale for establishing any team is to create synergy, so that the performance of the whole is greater than the aggregation of individual intelligence. As one project member reported:

"The success of any project is dependent on the quality of the team. Our service planning expertise is formed on the collective effort by the project team".

The researcher's observations show that in addition to the formal interactions such as project meetings and workshops, the team members from the various disciplines worked closely together through socialisation processes such as informal discussions and 'working lunch' gatherings. During these social interactions, members exchanged stories and experiences without the conscious effort of doing so, thus diffusing the deep tacit knowledge among individuals and creating a shared understanding among all team members.

The project team not only built and sustained working relationships, but it has, over the years, also accumulated a collective knowledge base. As evidenced from the various forms of documentation in the company's archives, communication processes such as meetings, emails, memos took place within the project team, embedding the knowledge in the company's technologies, structures and routines adding to the organisational memory. However, during the interviews most members commented that if the individuals in the team changed, the team would find it difficult to bring past discussions and actions to bear on a current decision. When asked to elaborate on this point, the marketing manager explained:

"It is more to do with the uniqueness of the current decision and the need to combine insights rather than data. Our past actions [as stored in databases] may not always be relevant to our current decisions".

Thus, it appears that in knowledge intensive work, explicit knowledge has only a limited usefulness, while the reliance is on personal skills-based perspectives.

To summarise, the empirical evaluation of proposition 2 reveals that the very high level of domain specific technical knowledge of the individuals contributed to the project's success. However, the individual members lacked the full knowledge required to undertake the roles of others. The multi-disciplinary nature of the project demanded the effective participation in teamwork, with people inside and outside the organisation. Thus the collective organisational knowledge overcame the limitations of the individual. Moreover, the team continuously combined and built on each other's knowledge, contributing to the organisation's accumulated and context specific tacit knowledge. The evidence from the case study suggests that this shared understanding formed distinctive, firm specific, organisational competencies leading to superior performance. Moreover, the firm specific, experiential nature of the knowledge makes it difficult to imitate by the competitors.

The above discussions suggest that at ConsultCo intelligence at both individual and collective levels was important for innovation and value creation. However, the value of this collective tacit knowledge created through members working together has limitations. The evidence suggests that staff turnover will disrupt the ability of the team to draw on experiential knowledge in order to operate effectively. Therefore the ability to create value depends on there being a stable collection of individuals within the team.

Table 5.2 presents the summary of case evidence relating to the indicators of proposition 2, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Intelligence at the individual level	• Education, training, experience and expertise	Tacit knowledge Track record of performance	Interviews, documents
Intelligence at the (collective) organisational level	• Employee tenure	Collective, accumulated knowledge	Interviews, documents
	• transference and diffusion mechanisms	Embedded rather than explicit knowledge	Interviews, documents
	• Collective learning	A social outcome (shared meaning)	Observations

Table 5.2: Summary of Evidence Relating to Levels of Intelligence in Proposition 2

Next, proposition 3 is examined in respect of the individuals' creativity within the organisation.

Proposition 3 - Creativity

Individual creativity is an antecedent of innovation.

Creativity as an Antecedent of Innovation

As discussed in chapter 3 (section 3.6), the key output measures of creativity and innovation are the novel and useful activities and the success of the product or service in terms of the benefits gained. The extent of the project's success is discussed under section 5.5 – Assessment of Value Creation. The researcher's observations show that the creative outcomes of project members were displayed in two main ways. Firstly, the team's conceptual insight and originality in ideas generated novel and useful solutions to the customer's initial problem, thereby winning the contract for the development of the NHS concourse. As described previously, the creative contributions in this respect include the innovative funding structure that was devised by the company in a way that minimised the Trust's risks. In the same way, the company pioneered the niche market of retail malls within hospital precincts that generate a guaranteed minimum annual income for the Trust in the next 25 years.

Secondly, the team continuously explored new perspectives to overcome potential problems during the implementation stages. For example, the team had to resolve the problem of building in flexibility to facilitate the expected increases in the patient-traffic flow in the next two decades. Many discussions took place within the team and they came up with the idea to avoid, as far as possible, dedication of function within an area. They established by consultation, the functional usage of space. Maximum flexibility was then designed to accommodate future change by minimising the need to undertake physical adaptations, which are expensive and disruptive. As a result, the design incorporated a structural frame and non-load bearing partitions, so that when physical change does prove necessary in the future, it would not involve structural alterations.

The key project members described their creative activities in terms of new and useful ideas that led to the innovative outcome. These included "uniqueness in our approach in solving problems set by the brief"[chairman], "creative use of alliance partnerships"[operations director], "risk-based planning"[strategic development director], "new legal structure to the lease documents"[development support manager] and the "designing of the management structure of the project"[business development manager]. The responses suggest that the project members produced creative solutions at different stages of the project, not just at the initial idea stage.

It appears that creativity and innovation occurred because the project team relied on their intuition, imagination and ingenuity to achieve a successful strategy. For instance, ConsultCo's

intuitive focus on value to the customer rather than value of the customer emphasised relationships with the multiple stakeholders, as opposed to transactions with the main customer, the NHS Trust. As a result, the project team achieved service quality, uniqueness of service and customer satisfaction. Moreover, the company enhanced their knowledge base, creating new knowledge for the company, through the close working relationships with the customer.

The above evidence suggests that innovation was just one of the value creating outcomes of creativity, as manifestations of creativity appeared in many different forms and produced many different forms of value.

Proposition 3a - Cognitive Characteristics as an Antecedent of Creativity

Individual creativity is influenced by two cognitive characteristics: (a) when there is task domain intelligence (declarative knowledge) and (b) when there is flexibility in combining rules (procedural knowledge).

The cognitive characteristics of individuals within the project team have already been discussed under propositions 1 and 2. It was described how the members used their task specific knowledge and their procedural knowledge to generate creative outcomes within the project. Those examples show that in approaching the challenges or the opportunities, the project members appeared to be influenced by and working within their technical *proficiencies and task* specific experiences. For example, the researcher observed during the various project meetings that the deep specialist knowledge of the members enabled them to both understand the complexities of the project and communicate this understanding so that other members of the team could build corresponding concepts and mental models.

Previous examples (discussed under proposition 1) also show that the expertise, technical proficiency and the intellectual skill of knowing how to apply this knowledge influenced creativity. For instance, the team's ability to "understand the customer's unmet needs" [chairman] created the novelty in service, where the team offered something no one else has offered and created the novelty in process where the team offered the service in ways their competitors could not match.

However, it was evident that while the project team applied their creativity to find new and different ways of creating value for the customer and the company, the professional nature of the tasks meant that most of the activities were directed at perfection and consistency. Only some elements of their work allowed any real flexibility and creativity in carrying them out. For instance the project team worked within their respective professional disciplines such as legal,

accountancy and engineering, in which they applied their advanced skills to complex problems within the guidelines set by the profession.

The cognitive skills as examined by the sub-proposition 3a determined what the project members were capable of achieving in a particular domain. However, as described in chapter 3 (sub-section 3.5.4), what the individuals will actually do is determined by the level of motivation that can be either intrinsic (resides in a person's own personality) or extrinsic (caused by external inducement such as rewards). While extrinsic motivation will be examined under proposition 4 – enabling conditions, the next sub-proposition examines the intrinsic motivation and personal orientation of the project members.

Proposition 3b - Behavioural Characteristics as an Antecedent of Creativity
Individual creativity is influenced by two behavioural characteristics: when individuals have (a) high intrinsic motivation and (b) a personal orientation toward creativity.

Almost all members of the ConsultCo's project team, and particularly the chairman, showed a deep involvement in the work and took joy in exploring and changing direction when solving problems. In contrast a few members in the administration function found their work repetitive at times. They said that their involvement in the project is somewhat limited due to the nature of their work, although they are motivated by the knowledge that their work is vital to the smooth running of the project. Among the key project members however, it was apparent that several features of task engagement contributed to high intrinsic motivation. When asked to indicate how task engagement affected the performance of their work, all key project members within ConsultCo said that they found the project work as 'challenging' and 'providing intellectual stimulation'. The researcher observed that they all displayed deep personal satisfaction in the work throughout the project. 7 (out of the 8) key project members said that they 'have a high influence in what happens in the project', while all members said that they have a 'high involvement in the work' and a 'feeling of accomplishment'. The need to attain the goals set was a top priority for most members, although a few said that priority was also to "ensure safety and quality". None of the project members considered the project as 'work' and instead they saw it as responsibility and something that they enjoyed doing. Minutes of the post implementation review meetings show that this enthusiasm was evident in the collaborative partners as well as in the customer representatives. ConsultCo's collaborative partner for construction states in a letter to the chairman of ConsultCo:

"Clearly a lot of effort has gone into the [hospital] development and this is a model that could be applied to future projects".

The Health Services Trust's project director has expressed his enthusiasm:

> "This is an exciting project, which has greatly improved the amenities and facilities available for the many patients, visitors and staff..."

It was apparent that the personal orientation of the project members contributed to their creativity. For instance, all members said that they highly rated the 'need for originality' and their approach to learning reflected this. The project was seen as an opportunity to entertain new ideas, learn and improve. A team member explains: "we keep modifying what we do". Interviews revealed that all members exercised freedom and independence of judgement in their work as far as circumstances permit.

Proposition 3c - Organisational Characteristics as an Antecedent of Creativity

Individual creativity is influenced by two situational characteristics: (a) when the problem is novel, unfamiliar or heuristic and (b) when an intelligent approach to problem solving is expected and valued.

All members said that they have a high familiarity of the circumstances and the problems posed by the project. However, five (of the eight) members said that they consider the project as having a high degree of complexity and novelty, while three members said that although they find the problem situation novel, they rate the project complexity as average and easy to handle. The reason for this, according to the latter three respondents was, because the company had undertaken similar development projects in the past. However, the former five respondents argued that the uniqueness of customer requirements meant that the project required methods that were different from past solutions. For instance, the task of re-designing the concourse was open-ended to a degree and the path to solution was not clear and straightforward, requiring the need to generate new ideas. Furthermore, the development activities had to be carried out in the midst of a fully operational hospital environment, thus requiring the project team to come up with novel and appropriate processes. When questioned about the possibility that the project team could be applying previous experience to new tasks in a rigid manner, the project's design and marketing manager disagreed and commented:

> "The project was all about complex re-designing of the ways that healthcare facilities are provided. It is true that our prior experience was useful here. However, I believe that the enemy of success is people stuck in their ways".

All interviewees said that their ability to be creative and generate potential solutions during the project was enhanced when there was collaboration and a spirit of co-operation available within the project team. As described in detail in the next sub-section under organisational capital, it was evident that ConsultCo's work environment, which characterised its participative management practices and processes, use of teams and the top management support available to the project team enhanced creativity.

In summary, the examination of the creativity propositions provided insights into how the cognitive, behavioural and organisational characteristics influenced the team's creativity that fostered innovation. As noted previously, At ConsultCo, the task specific knowledge formed the basis from which creative variations were made. The team members displayed high levels of intrinsic motivation and their readiness to entertain new ideas produced radical service redesign. It was apparent that the uniqueness and the novelty of the customers' problems enhanced the team's creativity. Thus challenging work was the most important intrinsic motivator. The members also found that collaboration in the project team and co-operation among the team influenced their creative abilities. The evidence suggests that the team's creativity has resulted in producing superior performance for the customer and business value for the company and that creativity has occurred at many stages in the project, not just in the generation of new ideas. Furthermore, it was evident that value was created in many different forms. Although none can act as a stand-alone measure of value creation, they all contributed to the value creating process. This suggests the need to combine various forms of value.

Table 5.3 presents the summary of case evidence relating to the indicators of proposition 3 and its sub-propositions, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Creativity (Creative outcomes of project members)	• Novel and useful solutions to problems	Originality in ideas, conceptual insight New perspectives to overcome potential problems	Documents, observation Documents, interviews, observation
3(a) Cognitive characteristics (domain knowledge and procedural knowledge)	• Deep specialist knowledge • Intellectual skill of knowing how to do something	Ability to understand and communicate complex concepts Novelty in service, novelty in process	Documents, interviews, observation Documents, interviews, observation
3(b) Behavioural characteristics	• Intrinsic motivation • Personal orientation	Deep interest in the work, a feeling of accomplishment Readiness to entertain new ideas, independence of judgement	Interviews, observation Interviews
3(c) Organisational characteristics	• Task novelty • Organisational expectations and recognition	Unique and complex problems Collaboration in the project team, top management support	Interviews Interviews, observation

Table 5.3: Summary of Evidence Relating to Creativity in Proposition 3

The human intellectual capital discussed so far need to be supported by the organisational structures such as the working atmosphere and management practices for effective value creation. For this reason the organisational capital dimension is examined next, through propositions 4 and 5.

5.4.2 Examination of Propositions Relating to Organisational Capital

The organisational capital dimension represents the institutional systems and the situational context that reflect how innovation and creativity of individuals are facilitated within the company. In this sub section, the two propositions relating to the enabling conditions and the situational factors are examined with the intention of establishing the internal contextual setting of the company.

Proposition 4 - Enabling Conditions

*Individual creativity results in innovation under four main enabling conditions: (a) when there is **opportunity for creative expression** (b) when there is an **absence of constraints** (c) when there are **adequate resources and support** to develop ideas and (d) when there are **incentives** that enhance intrinsic motivation.*

The key project members at ConsultCo were asked to assess their company in terms of its enabling conditions that contributed to the project's outcome.

All of the interviewees rated highly the availability of operational autonomy (the freedom to determine one's own actions) and the requisite power to act as enhancing their creative acts. The researcher's observations show that the employees displayed freedom over how their day-to-day work was done. According to the administration manager:

"It [the operational freedom] is useful as we need to apply a range of skills in different ways and with different people to get particular issues resolved".

When asked about the importance of autonomy and the requisite power to the team's creativity, the project leader stated:

"The individuals have the knowledge in their specific fields and hold the responsibility for the success of the project. The freedom to develop ideas and determine creative solutions to the project's problems is not only necessary, but vital to the project's success".

However, the researcher's observations show that the autonomy was exhibited more at the key project member level than at the operational levels suggesting that autonomy is proportional to the expertise, experience and the responsibility.

It was evident that the leadership was spread throughout the key project team and was not limited solely to the project leader. The key project members were leaders in their particular area of skill. The project members felt that they have the leadership support to address problems. The key project team encouraged the open flow of communication and provided constructive feedback, generating a sense of commitment from the team. The chairman stated that the support of the team compensates for the lack of leadership support that is available to him. One member described the support available to him as:

"To me, the strength of the leadership is, being able to discuss when we have difficulties".

All of the interviewees stated that when addressing a common challenge, sharing of knowledge was beneficial. As discussed below under rewards and incentives, individual performance is

linked to bonuses and bonuses are linked to outcomes of projects. Therefore, at ConsultCo, succeeding as a team is more important than ownership of individual ideas and so the team shared knowledge and experience freely and was mutually supportive. However, when asked about the support available to the team in terms of stimulating co-workers, there was disagreement among the project team on the extent to which their co-workers were stimulating. Six members found their co-workers very stimulating, while two others debated this. However, all interviewees agreed that interaction with colleagues was an essential part of their work because it created an enriched environment. Thus it appears that creative idea generation increases when people are exposed to other relevant ideas. The operations director stated:

"I develop a lot of my ideas in conversation with others as well as when I am on my own, reflecting".

Although project members experienced interruptions and excessive workloads at times, they reported that this did not affect their motivation. As discussed previously, evidence points to high levels of motivation and high autonomy within the team. As with any small company, the team enjoyed flexibility, loose job descriptions and very few rules and regulations resulting in low organisation resistance and inertia. The members also stated that they did not experience creativity inhibiting factors such as formalisation of processes and organisational inertia within ConsultCo.

When asked about the availability of resources within ConsultCo, all of the interviewees reported the lack of resources in terms of funds (budget constraints) and time (constraints on recruiting trainees and junior employees for delegating routine decision making) and felt that they could perform better if more resources were available. Moreover, most project members said that the electronic communication systems to provide information could be improved. The information flow at ConsultCo is facilitated by its small size, as employees are located in the same place. In contrast to the way companies rely on information technology to improve internal and external processes, ConsultCo has a very limited IT capability. This is congruent with the trends in the property sector, which is a low-technology industry sector and not noted for high use of information technology services. For instance, the use of technology at ConsultCo is limited to software packages for accounting, payroll, marketing presentations and architectural design as well as e-mail and the Internet facilities. However, there is recognition within ConsultCo about the need to incorporate more IT capabilities, over time.

The company had many forms of rewards and incentives to influence motivation and performance. Members reported that individuals' contributions were rewarded through

recognition and acknowledgement and were not always linked to financial rewards. For instance, there were many celebratory drinks and lunches to mark the successful completion of project milestones or to acknowledge a member's exceptional contribution. One such occasion was when the team successfully averted a long delay and significant levels of additional, unbudgeted costs half-way through the design stage, due to a late decision by the Trust to build a new clinical block on top of the reception area. The operations director came up with a plan to present the Trust with an alternative proposal of how the Trust could synchronise the two schemes. ConsultCo, together with their construction partner, then proposed a best value procurement route with a full open book policy, should the Trust decide on this alternative. The Trust accepted the proposal as it saved them a long and costly tender and planning process and later awarded ConsultCo with a management fee as recognition of the team's innovativeness.

Documentary evidence shows that the company has a generous bonus scheme for everyone, which is linked to company profit. ConsultCo recognises and rewards the accumulated skills in terms of expertise and experience through the salary structure. Most employees in the company hold stock options. These tend to secure loyalty and employment tenure of employees. Apart from the additional new hirers, the employee base has been with the company for more than five years, making the staff turnover rate of near zero within the last five years. The researcher found that the members displayed high levels of morale and commitment. The reason for this may be due partly to the pioneering culture ConsultCo has created and partly to the profit sharing incentive systems operated by the company.

In summary, at ConsultCo, opportunities for creativity and innovation were high. By allowing autonomy and providing encouragement, the company emphasised that creative effort is a top priority within the company. Leadership was evident in the directing and co-ordinating the activities of the project team and monitoring the team's performance against targets and milestones. Although the team members experienced some constraints in terms of interruptions and excessive workloads at times, all members reported very high levels of motivation and commitment. As with many small companies, the resources available for the team in terms of funds, IT, time and information were low. However, the team enjoyed generous rewards and incentives, which contributed to their extrinsic motivation. ConsultCo's case demonstrates that while technological competencies are a critical element of competitiveness, the ability to be creative and innovative is perhaps more important in a rapidly changing business environment.

Table 5.4 presents the summary of case evidence relating to the indicators of proposition 4, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Opportunities	• Autonomy • requisite power to act • leadership support to address problems • constructive feedback • shared team experience • stimulating co-workers	Very high Very high Very high Very high Very high High	Interviews, observation
Constraints	• Lack of motivation • Lack of control • Interruptions • excessive workload • formalisation of processes • organisation resistance and inertia	Very high motivation High control A lot of interruptions Excessive at times Very low None	Interviews, observation
Adequate resources	• Funds • Time • Information • IT	Low Low Low Very low	Interviews, observation
Rewards and incentives	• Recognition • stock options • profit sharing • Bonus schemes	Very high High Very high Very high	Interviews, observation, documents

Table 5.4: Summary of Evidence Relating to Enabling Conditions in Proposition 4

The work environment is further explored in terms of the organisational context, through proposition 5.

Proposition 5 - Organisational Context

Organisational innovation is influenced by two situational conditions: (a) high organisational orientation to innovation and (b) when situational factors favour the expression of innovation.

The company's innovation orientation is demonstrated by its ability to recognise and benefit from the changes in the business environment. The relatively small size of the company with its adaptive culture facilitates a quick response to rapid market changes and enables them to remain in the forefront of transformations. The company's innovative approach to the changing needs of Britain's hospitals was described in section 5.2 – Activities and Markets. As described previously, the recognition and reward of superior performance demonstrate the company's strong commitment to the innovation process. Furthermore, observations show that the project team was committed to working closely with the customer and other stakeholders to identify needs and link them with creative solutions.

All of the interviewees stated that the company has a sense of pride in the organisation's members. This was evidenced in the company brochure in which its employees were described as having unique skills and qualities. This may be due to employees being both professional and dedicated enough to see the projects through to successful completion. The multi-disciplinary nature of all ConsultCo's projects implies that the problem-solving skills are not restricted to isolated pockets within the organisation but spread organisation-wide.

ConsultCo's management philosophy that emphasises teamwork and high performance work has created a culture that nourishes innovative ways of addressing problems and finding solutions. This is evidenced in ConsultCo's staff-policy manual, that details the behavioural attributes expected of the collective organisation. These include: recognition of the importance of public accountability; achievement of best value for the customer while maintaining effective cost control; an open minded and proactive approach to new ideas without costly experimentation in the delivery of best value; provision of intellectually robust advice and proactiveness. The participative style of the management encourages members to attempt whatever is necessary to make things work. For example, one of ConsultCo's key skills is the way the team members apply "a lot of lateral thought beyond the brief" [design and marketing manager]. This is a skill that has been created through shared values and norms rather than instructions.

The shared values, beliefs and norms have become central to organisational learning at ConsultCo. For example, the knowledge and the experiential learning of ConsultCo's employees played a major factor for the company's innovative leadership in the industry. As described previously, the concepts and processes that had been developed in the preceding projects defined the basis from which new variations were created. Learning also occurred through the exchange of ideas both within the company and outside the company with business partners and customers. For example, in an internal memo addressed to the senior management team, the business development manager discussed the suitability of a prospective project as:

"An exciting scheme with a number of major opportunities and challenges. The scale of the project represents an excellent opportunity for us to demonstrate the full range of our creativity and innovation in the areas of design, construction and third party income generation. At the same time we will greatly benefit and learn from the business partnership with our regeneration partner who is involved in regeneration projects in housing, social investment and training".

As with any experience, the project enabled the team members to learn valuable lessons that they could apply in the future. Project members described some of the lessons learned as "more understanding of the psychology of the public sector officials"[chairman], "an appreciation of the sensitivity of the project" [design and marketing manager] and "new insights into how the NHS facilities should be designed, financed and operated" [finance director].

The team enjoyed flexibility, loose job descriptions and very few rules and regulations, evidenced when the design team stepped out of 'normal' work roles and stepped in to resolve an escalating issue between the existing tea-bar and the new commercial caterer that the development support team was dealing with unsuccessfully. The design team stepped in to suggest that the designs for the retail units could be changed in a way that the units will be re-sized and repositioned in order to keep apart the retailers with products directly in competition with each other.

When interviewees were asked if they believed the company had a formal approach to innovation, four (out of the eight) people said there was no formal approach, on the grounds that the company does not have a formal R&D function. The other four people argued that by actively encouraging creativity and by linking new ideas to business objectives, the company implied a consistent and formal approach.

In summary, it is apparent that while creativity is grounded in the experience and expertise of individuals, creativity is shaped into innovation by the managerial and social processes of the company. The company showed a strong commitment to the innovation process, which was manifested in their continuous innovation and in the high recognition of the members' contributions. ConsultCo had created an empowering culture, which nourished creativity by encouraging self-initiative. The evidence also suggests that creativity and its commercial potential emerged gradually through an incremental company-wide process of knowledge building and sharing. The company enjoys the advantages available to small firms of flexibility, ease of communication and rapid decision making.

Table 5.5 presents the summary of case evidence relating to the indicators of proposition 5, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Organisational orientation to innovation	• Commitment to the innovation process	Continuous innovation	Documents, observation
	• Sense of pride in the organisation's members	Very high recognition of members' contributions	Documents, interviews
	• A capacity for organisation-wide creative problem solving	Multi-disciplinary work teams	Documents, interviews, observation
Organisational structure	• Culture norms and values	Entrepreneurial culture	
	• Management practices	Participative style	
	• Learning capabilities	Experiential learning	Documents, interviews
	• Flexible structures and procedures	High autonomy, loose job descriptions, flat structure	
	• A formal innovation approach	No R & D capability, matches innovation with strategic objectives.	

Table 5.5: Summary of Evidence Relating to Organisational Context in Proposition 5

The next sub-section examines the role of collaborative intelligence in the value creation process.

5.4.3 Examination of Proposition in respect of the Relationship Capital

This sub-section examines the sixth and the final proposition of this research model (Figure 4.3 in Section 4.5) that relates to relationship capital. The essence of relationship capital is the knowledge embedded in collaborative relationships external to the firm.

Proposition 6 – Collaborative Business Intelligence

Innovation is influenced by collaborative business intelligence in the form of: (a) collaborative relationships with business partners and (b) collaborative relationships with customers.

Collaborative Relationships with Business Partners

The redevelopment of the hospital main entrance was characterised by intricate interdependencies among many specialised areas such as healthcare service redesign, commercial development, property management, architectural design, civil and structural engineering, and construction. The complex process required bringing together of a network of

collaborating organisations, each with its own proprietary, specialist skills. Each partnership was structured differently to suit the needs of the situation. The partner firms contributed on a continuing basis in key areas and pursued a set of agreed upon goals. They also shared the benefits of the partnership on an agreed upon basis. ConsultCo endeavoured to build close working relationships with all the partners. Two such partners, for example, were the construction partner and the design partner. The construction partner had a proven track record spanning sixty years and had successfully worked with ConsultCo on many previous projects. Therefore the teams from the two companies got to know and trust each other. The design partner was a young innovative architectural company with outstanding achievements. Initially, ConsultCo was uncertain how far its design partner had the capability to handle a hospital project. However, as ConsultCo had in-house design capability within the health sector, they were confident that they could support the young company. Thus the partnership involved an element of mutual learning, with the design partner gaining useful knowledge and experience about the health sector and with ConsultCo enhancing its in-house design capabilities.

When the interviewees were asked to identify the relative importance of benefits of collaborative relationships, resource pooling, long-term exchange of know-how, and risk sharing were all ranked high by different key project members. The responses accord with ConsultCo's management strategy of building partnerships as a source of innovation. The chairman explained:

> "We have been able to form partnerships with a number of excellent organisations. Many companies have taken an interest in partnering with us on various aspects because we have been identified as pioneers in this [healthcare] business. We have greatly benefited from these business partnerships".

The operations director described how the creative use of partnerships produced valuable outcomes:

> "We looked for compatibility of vision and mutuality of purpose. Once we understood what each partner wants to achieve, we worked towards a common goal and provided collective expertise in the marketplace. In our experience an open mind should be kept at early stages and the best options will become clear as project scope and parameters are established".

Thus, it appears that the choice of partner is as important as the complementarity of resources.

Access to technological advancements and the generation and protection of intellectual property were ranked low by all of the interviewees. ConsultCo's business needs do not involve the protection of intellectual property, as successful service concepts are not readily protected by intellectual property rights. It is therefore to be expected that the above two received a low assessment.

The collaborative agreement provided for regular meetings with the key team members within the alliance and the customer. The collaboration also involved frequent informal communication on a wide range of issues, which had been valuable, particularly in the early phases of the development. As the collaborative team members were geographically dispersed they were not in daily face to face contact. Because the project had clear milestones, it engendered a culture within the collaborative team of working to attain goals in a timely manner. The high degree of interaction between the project team and its external partners broke down the habits and thinking paradigms, encouraging reflection and articulation of tacit knowledge. This process challenged the in-house team with new ideas and different perspectives. For example, a team member commented:

> "There were many occasions when we were able to use feedback [from collaborative partners] to improve our ways of doing things".

The study also identified a number of potential risks associated with collaboration. The most commonly quoted risk was "the inability to realise the potential achievable by the project" [six of the eight interviewees], due to poor performance by the partners. The other potential risks included "one partner's interests prejudiced and another's enhanced" [business development manager]; "the ability of partners to steal the company's commercial modus operandi" [operations director]; and "partners not performing as a team" [administration manager]. ConsultCo contained these risks by "careful selection of partners" [administration manager], "continued informal dialogue and transparency" [strategy development director], and "including contingency plans as part of the partnership agreements" [finance director]. The development-support manager elaborated:

> "If the partnership is simply 'bottled together' for one purpose, there is no chance for it to grow into a serious team".

Conflicts of ideas were evident throughout the project, due to different professions and disciplines working together, with the collaborative members using different conceptual

approaches. In spite of this, relations between the partners have been good, with mutual trust and respect.

Although informal relationships and trust between the partners were considered important, partnerships between all stakeholders to the project were based more on accountability and less on trust. The contracts had reciprocal provisions in the event of breach of agreement or failure to deliver, together with provisions relating to ownership of assets following termination. Intense negotiations took place at the start to balance the interests of the partners. Terms of the agreement guaranteed an element of equality and minimised the possibility for opportunism.

In summary, a consistent theme found across the interviews was that working closely with reputable partners helped to extend and strengthen the company's profile of services offered to the customer and created new knowledge for the company through communication, learning and participation. The partnerships not only provided the needed complementary specialist knowledge, but crucially gave ConsultCo the credibility needed to win the NHS contract by "providing a pool of expertise" [development-support manager], without incurring the costs involved to develop these competencies in-house. Additionally, collaborative partnerships provided flexibility, as inter-company agreements were easier to dissolve than internal commitments.

In addition to the business partners, the other valuable partner in the collaborative relationship was the customer. The researcher next examines the company's strategy for customer relationships to illustrate how value was created through partnership with the customer.

Collaborative Relationships with the Customer

In view of the project's life span of 25 years, ConsultCo's relationship with its customer is best described as a strategic partnership. ConsultCo uses the term 'customer' loosely to incorporate the multiple stakeholders in the project: The NHS Trust, the regional health authority, the local authority, patients, visitors, staff representatives, disabled group representatives, the existing and prospective retail outlets and the social services. As noted previously, the stakeholders were considered valuable partners in the collaboration. The strategy development director commented on the team's service profile that is congruent with the true needs of the stakeholders:

"An understanding of the value to all the stakeholders was important in determining the context and the outcome of our service".

This understanding enabled ConsultCo to achieve customer-perceived value through compatibility of service, where the project was perceived to be consistent with the existing values, experiences and needs of the stakeholders.

ConsultCo's key project team, together with its collaborative partners, worked continuously with the customer to conceptualise and articulate the needs of the multiple stakeholders. As the project's development support manager explained:

"We take on board the customer's unique requirements and attend to them with experience, commitment, soul and an understanding of the NHS culture".

The resulting insights into the customers' tacit needs allowed the company to deliver a highly customised product incorporating unique features in ways their competitors could not. As described in section 5.3 – Project, these unique features included both economic and non-economic factors.

In addition to focusing on the customers' requirements, the team focused on building long-term customer relationships. As noted earlier, the company promotes an 'open book' policy where all decisions and expected outcomes related to the project are freely made available to all stakeholders, encouraging trust and loyalty in the process. The operations director commented:

"Our focus has to be on the goal of building customer relationships by providing superior customer perceived value. We achieve this through dialogue and by looking at the service from the perspective of the customer".

These close working relationships themselves had an effect on the total value perceived by the customer, evidenced, as described previously, when the Trust actively co-operated with ConsultCo to avoid a long delay and additional costs to ConsultCo. Thus ConsultCo created value through on-going relationships that extended beyond individual transactions.

The team's emphasis on the central role of the customer was evident throughout all stages of the project from design through construction to completion. ConsultCo's design and marketing manager comments:

"Although we used our expertise to ensure that the process ran smoothly and was as straightforward as possible, at every stage the Trust was consulted to make sure that they were happy with the way the project was developing".

Thus, ConsultCo ensured customer satisfaction by monitoring the impact of their service to the customer and taking prompt action to iron out issues, evidenced when the team acted to resolve a dispute over the sale of products in the retail outlets that were directly in competition with each other.

To summarise, ConsultCo, together with its collaborative partners translated the customer requirements into unique product features. This suggests that understanding customer needs was essential to the success of the project. As evidenced in the project, innovation emerged in collaboration with the stakeholders. The company achieved product differentiation through the quality of its service and other unique features, both economic and non-economic. ConsultCo's focus on service quality also reduced costs by improving work processes and resolving disputes that could lead to costly 'reworking'. The illustrations above suggest that value creation at ConsultCo depended on the ability of the company to provide what is of value to the customer.

It appears that the collaborative partnership was successful because the respective partners were complementary rather than competitive. Evidence suggests that the company had many motives for the alliance partnerships including access to resources, extending the service profile and the opportunities to learn. It was interesting to note that the executives' biggest concern in relation to alliance partnerships was, 'not realising the potential achievable by the project'. This suggests that the company viewed the success of the project not only in terms of its profitability, but there was a growing realisation that successful completion of a project can bring about other organisational benefits. Therefore the company views the measure of success as multidimensional and dynamic in order to capture the different objectives. These are discussed in detail in section 5.6 under assessment of value created by the project.

Table 5.6 presents the summary of case evidence relating to the indicators of proposition 6, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Relationships with business partners	• Complimentary resources	Proprietary skills Internalisation of know-how	Documents
	• Compatible partners	Mutuality of purpose	Interviews
	• Diverse perspectives	Created conflict, but at the same time, helped to articulate tacit knowledge	Interviews
	• Resource pooling • Broadening the product/service portfolio • Exchange of know-how • Risk sharing	Rated as highly important to ConsultCo	Interviews
	• Access to technological advancements • Generation and protection of intellectual property	Rated as low importance to ConsultCo	Interviews
	• Potential risks of collaboration	Limit risk by careful selection of partners and many contingency plans	Interviews
	• Trust versus accountability	Very high accountability	Documents
Relationships with customers	• Strategic partnerships with customers	Value was created through ongoing relationships with the customer	Documents, interview, observation
	• Multiple stakeholders	The focus on values and needs of multiple stakeholders	Documents, interview, observation
	• Open-book policy • Customer satisfaction	Encouraged trust and customer loyalty	Documents, observation

Table 5.6: Summary of Evidence Relating to Collaborative Intelligence in Proposition 6

The sub-sections 5.4.1 – 5.4.3 examined the six propositions relating to the three dimensions of intellectual capital in an innovative context. In doing so, the researcher examined the impact of each construct of the theoretical framework on organisational value creation. The next sub-section provides an overview of the outcomes of the empirical examination.

5.4.4 An Overview of the Outcomes of Examining the Propositions

Findings from study one provide empirical support for all of the propositions from the research model (Chapter 4, Figure 4.3), albeit at varying degrees. The study found *very strong support for propositions 1, 2 and 3* that relate to the human capital at ConsultCo. For instance, as discussed previously, the quality of the project team, the collective learning and the shared understanding of customer needs were critical to the company's new service development capabilities. It was evident that the team was intrinsically and extrinsically motivated and this high motivation influenced the team members' willingness and their ability to search for creative solutions. Of the two propositions that relate to organisational capital, *proposition 4 in terms of enabling conditions* has only *moderate support*. The supportive environment as denoted by the availability of opportunities and the absence of constrains, as well as generous incentive schemes enhanced the creativity of employees. However, the interviews indicated that the performance of employees was constrained by the very limited availability of resources in terms of funds, advanced information and communication technologies (ICT), relevant information and sufficient time. *Proposition 5, in terms of organisational orientation to innovation and organisational structures has strong support.* For example, ConsultCo has a high level of commitment to the innovation process. Specifically its management practices, flexible structures and the culture encourage creativity and innovation throughout the organisation. However, the company does not have a formal R & D function. Therefore, ConsultCo's formal approach to innovation is limited to the organisational encouragement and linking innovative ideas with strategic objectives. Finally, *very strong support was found for proposition 6*, indicating that relationship capital played a vital role in the company's value creating process. This was evidenced in the way the company stimulated its internal innovativeness through complementary skills and resources acquired from strategic partnerships with both customers and business partners.

Support for the propositions suggests that intellectual capital factors have a strong impact on innovative performance and that innovation is influenced by individual efforts and management practices to facilitate creativity. The wide-ranging nature of the propositions and the interdependence between them forced a look at organisational innovation from a holistic view.

The study's findings that different IC factors influence value creation at different levels present managerial and academic implications, which are discussed in chapter 7. In order to illustrate the relative contribution that each construct made to the company's value creating process, a 5-point Likert type scale was used where the strength of the evidence was rated from very weak to very strong. As noted previously, the evidence represents the perceptions of the key project members triangulated with observation data and company documents. These perceptions and

the researcher's observations were summarised at the end of each proposition. Because the researcher was unable to find extant measures in the literature for the constructs used in this study, the evidence has been rated subjectively, using the perceptions of the 8 key project members as a guide to assess the strength of each construct. The Table 5.7 illustrates the 5-point Likert type scale.

Perceptions of key project members, used as a guide to assess the strength of each construct.	Very Weak	Weak	Moderate	Strong	Very Strong
For example, the number of interviewees who displayed agreement to constructs of the propositions	3 or less	4	5	6 or 7	8

Table 5.7: The 5-Point Scale Used to Assess the Strength of the Evidence

Following from the above discussions, Table 5.8 summarises the outcomes of the empirical investigation in terms of each proposition examined.

Proposition	Construct	Summary of empirical evidence	Deductive test outcome
P1 – Types of intelligence *There are two main types of intelligence that are associated with the innovation process. They are (a) technical knowledge that is relevant to the task or problem, and (b) social, political and interpersonal knowledge that is specific to the organisational context.* *Both types of knowledge are characterised by procedural knowledge (know-how) that enables the combination and recombination of declarative knowledge (know-what).*	Technical knowledge (Domain relevant intelligence)	As per table 5.1	**Valid** **Very strong**
	Social, political and interpersonal knowledge	As per table 5.1	**Valid** **Very strong**
	Combination of procedural and declarative knowledge	As per table 5.1	**Valid** **Very strong**
P2 – Level of intelligence *There are two main levels of intelligence that affect the innovation process. They are (a) individual intelligence that is domain specific and (b) organisational intelligence that is context specific.*	Individual intelligence	As per table 5.2	**Valid** **Very strong**
	Organisational (collective) intelligence	As per table 5.2	**Valid** **Very strong**
P3 – Creativity *Individual creativity is an antecedent of innovation.*	Creative outcomes of project members	As per table 5.3	**Valid** **Very strong**
P3a – Cognitive skills *Individual creativity is influenced by two cognitive characteristics: (a) when there is task domain intelligence (declarative knowledge) and (b) when there is flexibility in combining rules (procedural knowledge).*	Domain knowledge	As per table 5.3	**Valid** **Very strong**
	Flexibility in combining rules (procedural knowledge)	As per table 5.3	**Valid** **Very strong**
P3b – Behavioural Characteristics *Individual creativity is influenced by two behavioural characteristics: when individuals have (a) a high intrinsic motivation and (b) personal orientation toward creativity.*	Intrinsic motivation	As per table 5.3	**Valid** **Very strong**
	Personal orientation toward creativity	As per table 5.3	**Valid** **Very strong**
P3c – Situational Characteristics *Individual creativity is influenced by two situational characteristics: (a) when the problem is novel, unfamiliar or heuristic and (b) when an intelligent approach to problem solving is expected and valued.*	Task novelty	As per table 5.3	**Valid** **Moderate**
	Organisational orientation	As per table 5.3	**Valid** **Strong**

P4 – Enabling Conditions *Individual creativity results in innovation under four main enabling conditions: (a) when there is opportunity for creative expression (b) when there is an absence of constraints (c) when there are adequate resources and support to develop ideas and (d) when there are incentives that enhance intrinsic motivation.*	Opportunities	As per table 5.4	Valid Very strong
	Absence of constraints	As per table 5.4	Valid Moderate
	Resources	As per table 5.4	Valid Weak
	Rewards and incentives	As per table 5.4	Valid Strong
P5 – Organisational and Situational Context *Organisational innovation is influenced by two situational conditions: (a) high organisational orientation to innovation and (b) when situational factors favour the expression of innovation.*	Organisational orientation to innovation	As per table 5.5	Valid Very Strong
	Organisational structures	As per table 5.5	Valid Strong
P6 – Collaborative Business Intelligence *Innovation is influenced by collaborative business intelligence in the form of: (a) collaborative relationships with business partners and (b) collaborative relationships with customers.*	Relationships with business partners	As per table 5.6	Valid Very strong
	Relationships with customers	As per table 5.6	Valid Very strong

Table 5.8: Outcomes of the Examination of Propositions at ConsultCo

This section and its sub-sections have discussed the propositions and their indicators on an individual basis and have examined the value creating potential of the company's intellectual capital factors. The IC factors represent the 'what' that is required to achieve value creation while the interrelationships between them represent 'how' value is created. Based on the examples and discussions presented so far, the next section explores the interrelationships of IC factors that contributed to value creation within ConsultCo.

5.5 Interrelationships among IC Factors to Facilitate Value Creation

Identifying the different components of the intellectual capital factors and their relative contributions provided a basis for understanding the antecedents of value creation. However, the components by themselves represent the static element of intellectual capital or the stock of knowledge. For example, the individual intelligence of ConsultCo's employees or the intelligence gained from external sources provides a 'snapshot' in time of the static intangible resources of the company. These resources form the basis of unique value-creating strategies. As discussed in chapter 2, the process of turning the knowledge stock into action in order to create value involves a continuous interplay among the human, organisational and relationship capital and contributes to the development of strategic capabilities. For instance, it was evident

that ConsultCo's strategic capabilities such as the development of new service concepts, responsiveness to market trends, management talent and the formation of alliance partnerships were not identifiable with one dimension of intellectual capital, but were a combination of various elements. Further, the examples in the previous sections show that these organisational capabilities were developed over time through complex interactions among the company's intangible resources, as a response to dynamic market conditions. The complexity of interactions infers that the ability to create value lies in the firm's capacity to integrate, build and reconfigure resources through its human capital, as discussed below.

Drawing on the empirical investigation and the discussions in the previous sections, the research identifies the integration mechanisms employed by ConsultCo to create value into three broad categories, based on their strategic roles. For instance, at ConsultCo, some processes exploited the existing resources and skills, while others acquired new competencies. The third category of processes accumulated firm-specific skills through activities such as organisational learning. It was evident that the company used a mixture of these integration mechanisms, not just a single form, to develop strategic capabilities. Each category of integration mechanisms will be discussed next.

5.5.1 Combine Existing Skills and Resources

The discussions in the previous sections indicate that ConsultCo developed capabilities by combining and reconfiguring existing skills and resources. Here ConsultCo created value by two means. First the company extended its capabilities by *combining existing knowledge*. Combining ConsultCo's skills and resources that were often invisible and that consisted of experience, intellectual competencies and insights of its members was essential for the project's success. Although the core competency of the company lies in the individual experts, the specialised knowledge of the individuals could not on its own, create value for the company because the total project knowledge was not available to any of the individual members. Therefore the company actively used cross-functional teams and integrated different specialities and functions to provide customised solutions. The most striking feature at ConsultCo was the tendency of members to hold knowledge tacitly in their heads rather than on paper or in databases. It was also apparent that valuable knowledge resided in individuals and relationships throughout the company, and not simply at the key project member level. As discussed under proposition 2, ConsultCo embedded this tacit knowledge within the collective mind of the company by facilitating close working relationships, initiating periodic meetings and minimising cross-competition. Working closely with each other developed a high level of group experience (experiential group knowledge), which was influenced by the organisational culture that valued diverse perspectives of others and the management practices such as carefully

designed incentive schemes. Thus, at ConsultCo, the effectiveness of the integration of existing skills to accomplish complex tasks depended on the development of personal relationships and a better understanding of each other's capabilities. This know-how that is based on both tacit and socially complex knowledge generated a valuable set of capabilities that are difficult to reproduce by competitors. The dynamic interactions also created new knowledge as evidenced in the statement by the operations director, described under proposition 4: "I develop a lot of my ideas in conversation with others...."

Second, the company created new capabilities by *reconfiguring its existing knowledge.* ConsultCo's project team created new service concepts for the customer by *reconfiguring their existing knowledge bases.* It involved drawing together the experiences gained in the previous projects, recognising the common themes and applying them in new combinations to create new approaches to competing. For example, based on their previous work, ConsultCo devised new forms of leasing structures and funding formulae in order to provide new and improved benefits to the customer and in turn create value for the company. The co-ordination of multiple streams of knowledge to build new competencies implied a constant search for alternatives to current practices and procedures. These improvements and changes enabled future-oriented activities to take place by identifying and eliminating outdated activities that failed to add value.

5.5.2 Acquire and Internalise New Knowledge from Outside

The integration of knowledge was not limited to internal activity. As described in sub-section 5.4.3 under relationship capital, ConsultCo's team acquired new capabilities by creatively *integrating the internal skills with the know-how from external partnerships.* Here, the company created value by three means. First, ConsultCo achieved competitiveness by *establishing proprietary access to the specialised resources* of its alliance partners through strategic partnership arrangements. Second, the *learning and adapting* employed by both the individuals and the project team as a collective stimulated internal innovativeness and contributed to the company's ability to produce valuable outcomes from the partnerships. Third, the company created customer perceived value by *establishing close working relationships with the customer and related stakeholders.* The three approaches are briefly described next.

Access to external knowledge was necessary because ConsultCo's specialised base of knowledge lacked the broad range of skills needed to provide the total customer solutions. For instance engineering and construction capabilities were outside the company's traditional areas of business. Thus the external relationships with business partners represented the complementary skills and resources that the company has access to. As a result of the complementarity of resources, all partners viewed the relationship as an investment with mutual

benefits. The integration of different types of specialist knowledge, for example, the internal skills of NHS strategy development and long-term project management with the external skills of design and construction, was achieved and sustained through formal and informal processes. For example, while the setting up of the strategic partnerships involved complex contractual agreements to balance the interest of the partners, working relationships were forged through mutual trust, transparency, feedback-loops and frequent communication. Conflict was resolved by negotiation, arriving often, at win-win solutions.

The collaborative partnerships provided efficient mechanisms for learning and internalising of external knowledge by the project team, thus creating new knowledge within the company. The regular contacts and personalised relationships not only enabled the attainment of project goals, but they generated the gradual step-by-step build up of tacit knowledge between parties. ConsultCo's careful selection of partners meant that these exchanges of knowledge did not result in competitive rivalries. The exchange of knowledge was facilitated by the company-wide beliefs and norms that recognised the value of alliances and the availability of routines and structures that facilitated the knowledge exchange.

As discussed in the next section, ConsultCo delivered a fundamental customer benefit through the long-term relationships with the customer and related stakeholders that enabled ConsultCo to identify the customer's unique needs. The company built new thinking in the light of new experiences such as learning the customers' needs. These new insights gained by the project team developed new knowledge and competencies and facilitated continuous innovation. The project team achieved service quality by combining technical capabilities, functional capabilities and past reputation. It was evident that the company's 'brand image' due to past successes played an important role in the value creation through the development of customer loyalty and trust.

5.5.3 Accumulate Firm-Specific Skills and Resources

The integration of internal and external knowledge over a period of time resulted in an incremental accumulation of knowledge and strategic capabilities within ConsultCo. It was evident that ConsultCo accumulated knowledge through three main practices. First, the project members engaged in *learning by doing,* which accumulated experiential knowledge. For instance, the ongoing success of the company was based on the employees' ability to build on successful patterns and concepts that had been developed in the preceding projects. For example, as discussed previously, the project members attributed the company's ability to provide a distinctive service to the customer, to past experiences. In the same way, internal learning and the company's prior related knowledge developed 'absorptive capacity', which

enabled the company to recognise the new external knowledge, internalise it and apply it to commercial ends. As discussed in chapter 2, the absorptive capacity is based on employees' skills as well as the organisational processes that influence the communication and exchange of knowledge within the company.

Secondly, the company *embedded its knowledge in the routines, structures and procedures* through social interaction and codification processes, adding to the organisational memory. ConsultCo's routines, procedures and structures defined how projects were managed, how it co-ordinated the activities of different functions and how it served the customer. For example, the company's routines that nurtured long-term relationships with the customer created a two-way knowledge stream between the customer and the company, giving rise to idiosyncratic and difficult to imitate knowledge.

Thirdly, the company *accumulated and held knowledge as a social collective*. It was evident that the project members continuously exchanged stories and reflected on actions and outcomes, which translated their experiences into collectively held knowledge. Thus, the members were able to modify their actions in the successive projects based on the knowledge they had developed. For instance, as described previously in sub-section 5.2.2, the new projects undertaken by ConsultCo built on the company's prior related knowledge. However, the team could not develop collective knowledge by simply communicating. The regular interactions around work related issues and challenges immersed the team in problem situations collectively, which facilitated the drawing on and applying their tacitly held knowledge. The shared norms and language within the cross-functional team provided the appropriate context for developing the collective skills. This process of developing firm-specific skills was the essence of ConsultCo's innovativeness.

In summary, ConsultCo created strategic capabilities by integrating the human, organisational and relationship capital. The above discussions show that value creation cannot be explained only in terms of the company's individual intellectual capital resources. Rather, value creation requires that companies develop, adapt, integrate and reconfigure intellectual capital resources for implementing strategies that serve the requirements of a changing environment. This research identified three main categories of integration mechanisms that were in operation at ConsultCo. These mechanisms, due to their company-specific, idiosyncratic nature, combine resources in ways that are difficult to imitate by competitors. It was evident that the opportunities these mechanisms afforded were shaped significantly by the intellectual capital the company possessed.

The table 5.9 summarises the case evidence relating to the integration mechanisms that were used by the company.

Strategic Role	Integration Mechanisms Used by the Company
Combine existing resources and skills	• Use of cross-functional teams to combine different specialist knowledge • Creation of new service concepts
Acquire and internalise new knowledge from outside	• Creative use of alliance partnerships to establish access to complementary resources • Learning and adapting • Close working relationships with the customer
Accumulate firm-specific skills and resources	• Experiential learning that resulted in expertise in the health sector • Embedding knowledge in the routines and processes • Develop collective knowledge

Table 5.9: Summary of Evidence Relating to Integration Mechanisms

Having examined the propositions in respect of the individual intellectual capital factors and the mechanisms with which value was created at ConsultCo, the next section examines the evidence for value creation.

5.6 Assessment of Value Creation

As discussed in chapter 2, the essence of value is the prospect of benefits. In this section these benefits are examined both from the perspective of the customer (the extent to which the customer appreciated the benefits) and from the perspective of the company (the stream of future benefits that intellectual capital and the strategic capabilities it created will bring to ConsultCo).

Benefits to the Customer

The benefits to the customer were assessed using the documentation relating to the customer such as press releases by the customer and minutes of meetings. The customer perceived the provision of the retail development and the enhancements to the main entrance of the hospital as a novel and useful solution to a problem that they had identified. In a press release, the Trust's Project Director explains the necessity, the novelty and benefits the project brings to the hospital and the end users:

"The project was prompted by our need for an upgraded front entrance, which could not previously be contemplated as all funds were needed for patient care. However, this scheme provided the hospital with the opportunity to modernise and complete refurbishment of the main reception area with all the risk carried by ConsultCo. The development would contribute to ensuring that the time spent in the hospital is as relaxed as possible. This initiative not only provides better facilities for patients, visitors and staff but a more appropriate image for the hospital as well as a steady income stream".

Thus the customer perceives the service as a new concept and that the project provides a benefit previously unavailable to the customer. The project had a set of unique features that reflected the needs (both articulated and tacit) of the customer. Each of these features had to be conceptualised, articulated, designed and put into practice, with the form of the project emerging from the development process.

The satisfaction of the customer and the related stakeholders with the design of the project was evident in the decision to award the contract to ConsultCo, as noted in the minutes of a board meeting at the Trust:

"In the selection of a preferred partner, the Trust Board proceeded to a competitive exercise involving three experienced development companies who each presented a feasibility study outlining their views on a retail development and proposing the commercial consequences of their continuing management of the retail enterprises. Of the three, ConsultCo were selected for their imaginative proposal, their superior financial contribution to the Trust with no Trust risk to capital and a guaranteed stream of income during the lease period".

The collaborative team delivered customer value by striving to offer a quality of service that exceeded customer expectations. The minutes of post-implementation review meetings show that customer's expectations have been met throughout the various stages of the project. The Trust's project director comments on the quality of the project in a newsletter:

" The modernisation work on the main reception satisfies the Trust's brief to provide a unique, visual and user-friendly entrance to the hospital. Although the development is not especially high cost, it is highly prestigious, with major improvements to patient and reception facilities".

Moreover, both the customer and ConsultCo agree that the partnership, as denoted by the mutual co-operation and the share of future revenues will continue for the next 25 years, which is confirmed by legal agreements.

Benefits to the Company

In order to assess the value of the project to the company, the interviewees were asked to comment on the degree to which the project created benefits. All project members felt that the project was a success, thereby benefiting the company and the customer for the foreseeable future. Six (of the eight) key project members stated that the project had a very high contribution to competitive advantage in terms of the project's unique features in relation to the competitors' products. One interviewee, for example, described how a 'cluster of intangibles' such as customer advice, shared knowledge and close working relationships delivered better customer value than the competition. However, a majority of interviewees identified "dealing with intense competition" as the biggest challenge faced by the company. All are of the opinion that the project enabled the company to enhance its reputation as illustrated with articles in the trade press. All of the interviewees highlighted that the company reduced the effects of the competitors' efforts and that this was achieved through the partnership style of relationship with the business partners as well as with the customer.

Interviewees were split on whether or not the project contributed to the sustainability of competitive advantage. Those who agreed mentioned that the long-term customer relationships, the accumulated know-how that is firmly anchored in the company and their innovativeness would enable the company to stay ahead of the competition. The others who disagreed said that the project's concept could easily be imitated by competitors.

Most key project members maintained that the project offered potential for the future. "Generation of repeat business with the same customer or similar customers" was mentioned as the principal benefit gained by the successful completion of the project. Other future benefits mentioned included the long-term revenue stream generated by the project and the ability to pursue new markets in the future.

In addition to the commercial benefits gained by the project, several other types of benefits surfaced during the interviews. The primary non-financial benefit was new insights gained that were directly attributable to the close working relationships with the customer. For example, the key project members often cited the recognition of unique needs and preferences of the customer that enabled ConsultCo to be more customer-orientated and to minimise potential disputes. A second non-financial benefit mentioned was the creation of new knowledge within

the company by pooling the expertise of the collaborative partnership. However, this new knowledge was ultimately translated into a financial benefit through the innovative service. The third type of benefit cited by most interviewees was the improved working environment in terms of the motivation and commitment of employees that the success of the project created. Finally, a fourth category was the improved trust and co-operation between the business partnerships, which in turn translated into commercial gain through the collective experience in the marketplace.

In summary, it appears that ConsultCo creates value by delivering 'value to the customer' through their unique service that satisfies the needs of all stakeholders involved. The company considered that customer satisfaction was of the utmost importance to the project's and in turn to the company's success.   This was evidenced in the high importance that the key project members attached to the customer-perceived value. It is apparent that the members are aware of the need to innovate continuously in order to create the long-term advantage. It appears that the indirect benefits as mentioned above, also contributed to ConsultCo's strategic advantage. The above findings suggest that value was created not just by the individual IC factors, but through the distinctive capabilities, which the interrelationships between IC factors generated.

Table 5.10 presents a summary of the case evidence that was visible within the company generally, and more specifically, within the project team, as relating to value creation.

Indicators of Value Creation	Case Evidence	Source of Evidence
Benefits to the customer	• New and useful solutions to problems	Documents
	• Stakeholder satisfaction	Documents
	• Quality of service	Documents
	• Close working relationships	Documents
Competitive advantage	• Unique features relative to competitors' products	Interviews
	• Enhanced reputation	Interviews, documents
	• Reduced effect of competitive efforts through partnerships	Interviews
Sustainability (length of time a competitor would need to acquire the company's competence)	• customer relationships through long-term partnership	Interviews
	• Innovation	Interviews
	• Accumulated know-how	Interviews
Potential for the future	• repeat business	Interviews
	• Ability to enter new markets	Interviews
	• Long term revenue streams	Documents
Non-financial benefits	• New insights	Interviews
	• New knowledge	Interviews
	• Improved working environment	Interviews

Table 5.10: Summary of Case Evidence for Assessing Value Creation

5.7 Conclusions from Case Study One

In conclusion, this chapter has attempted to understand two aspects of value creation. First, the research explored the incidence of value creation due to the existence of specific types of firm specific intellectual resources. Second, the research examined the interrelationships between the various intellectual capital factors that enabled value creation.

In particular, the chapter examined the IC factors that effected innovation. The mechanisms with which the company deployed the intellectual capital and transformed them into desired activities were analysed. These were then categorised into three broad areas based on their strategic roles. The setting for the empirical investigation has been ConsultCo, a small innovative organisation that provides a complex service within a project structure. The project's multi-functional team consisted of both internal functional experts and external organisations with complementary skills. The multi-functional nature of the internal team means that it is representative of the organisation. In contrast to traditional organisational structures, ConsultCo

operates as a highly networked company both internally and externally, representing a dynamic innovative context. Findings indicate that ConsultCo creates value through creativity and innovation. However, since these innovations rapidly become routine features in the industry, continuous innovation has become a necessity for ConsultCo to remain competitive. The company's core asset and the sole 'factor of production' is intellectual capital, specifically, the skills of its employees.

It was evident that ConsultCo's expertise, learning from experience, business relationships, values and norms and management practices are very much interrelated. These interrelations resulted in firm-specific, strategic capabilities. For instance, the company's openness to ideas from outside resulted in continuous learning and replenishment of knowledge. For example, as noted previously, one project member described how the pooling of internal knowledge and the complementary skills of the collaborative partners resulted in increased competitiveness by improving the value of innovations to customers. The participative style of management encouraged self-initiative and interdependence among employees. In the absence of an advanced technology infrastructure, the company places heavy emphasis on embedding the knowledge and experience in the organisational routines and processes through active communication and social interaction. This implies that the nature of knowledge is experience-based rather than objective and that the company contains a vast element of accumulated tacit knowledge, the skills that become inherent and reflexive, making it difficult for competitors to imitate. This also implies that the knowledge base of the company is not solely dependent on certain individuals, but consists of collective organisational knowledge, which is the result of long-term teamwork.

In addition to providing empirical support for the propositions, the project findings have highlighted three related aspects of value creation. First, evidence suggests that innovation was an iterative process and the sharing of tacit knowledge within a group of people facilitated this process (example on page 22). Second, it was apparent that in knowledge-intensive work, explicit knowledge has only a limited usefulness, while the reliance is on personal, skill-based perspectives (example on page 27). Third, innovation was just one of the value creating outcomes of creativity, as manifestations of creativity appeared in many different forms and produced many different forms of value (reference page 30). While not necessarily unique when taken separately, these elements did combine to contribute to the value creating process.

The next chapter examines the same propositions in the context of case study two – ResearchCo.

Case Study Two – Research Findings

6.1 Introduction

The previous chapter examined the propositions in the context of study one - ConsultCo. The aim of this chapter is to examine the same propositions in the context of study two – ResearchCo. The findings from the two case studies will then form the basis for the cross-case analysis that is presented in the next chapter, where the research compares and contrasts the value creating potential of the IC factors within the two companies in order to develop a descriptive framework.

The focus of this study was a recently completed new product development project with strategic importance to the company due to the major breakthrough in technology that the product achieved. As noted in chapter 5, in testing the propositions of the research model, it is not the intention of this empirical investigation to describe the stages of the innovation process, but rather to examine the role of intellectual capital in the context of innovation.

The chapter presents the findings from ResearchCo following the same structure as that of the previous chapter. Here again the chapter is divided into five main parts. First, section 6.2 and its sub-sections provide a description of the company. The next section 6.3 and its sub-sections then present a description of the project, its nature and the challenges faced by the project team. Section 6.4 and its sub-sections 6.4.1 to 6.4.3 are devoted to examining each proposition of the theoretical model that is organised in relation to the three dimensions of intellectual capital – human, structural and relational. Section 6.5 then reviews the mechanisms with which IC factors were integrated to create value. Section 6.6 assesses the extent to which the project created value for ResearchCo. Finally, section 6.6 discusses the conclusions from the study at ResearchCo.

6.2 The Context

This section provides the contextual information of the second case study of this research and outlines its background, activities, markets and human resources. The context is described from an intellectual capital perspective.

6.2.1 Company Background

The second case study of this research, ResearchCo is a research and development enterprise based in the UK. A wholly owned subsidiary of a small and medium sized enterprise (SME)[1] engaged in intellectual property management, the company has contributed to many landmark innovations. The Group's international expertise in intellectual property protection and licensing is extensively used by other organisations. The group is traded on the London Stock Exchange and is a constituent of the Techmark 100 index.

Although the group was formed recently as part of a management buyout of three technology subsidiaries from a leading conglomerate, the individual subsidiaries have been in existence for a considerable time. For example, the origins of ResearchCo as a high-powered central research laboratory can be traced back to the 1920s, when the conglomerate founded it. Some of the principal innovations since the formation of ResearchCo include stereophonic sound, television technology that gave effect to television broadcasting and the Nobel prize-winning CAT brain scanner. Thus the company's focus on intellectual property and technology is based on this long tradition of technological innovation.

ResearchCo has an annual sales turnover of around £10m and a human resource base of approximately 100 employees. The company's core asset is its patent base in the various technologies. ResearchCo operates in marketplaces where technology is the key to competitive advantage.

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[1] A company classified as an SME has fewer than 250 employees and an annual sales turnover not exceeding 50 million Euro or an annual balance sheet total not exceeding 43 million Euro.

6.2.2 Activities and Markets

ResearchCo's core business is the generation of new commercial opportunities for customers by the creation, development and protection of advanced technologies and products. In addition to the many projects carried out on behalf of the customers, the company *originates high technology inventions (e.g. ferroelectric liquid crystal technology)*, which it then develops with partners to create patented products for licensing or sale. On average the company has about 200 third party customer projects in progress, and about another 100 internally funded R & D projects. The life of these projects may span from just 3 months to 10 years.

ResearchCo makes a substantial investment in its research and development programmes, amounting to a level of around 10% on sales. Proposals for corporate funded R & D programmes are considered and approved by the Operations Board. Almost all innovations by the company are market-led. For example, the R & D programmes are specifically aimed at finding technological solutions to identified needs in carefully selected markets.

ResearchCo's commercial approach extends to taking new technologies from invention into design and development and as appropriate, into licensing and subcontract-manufacture and sale. The company's products are sold or licensed in over 30 countries. By planning the commercial exploitation of the outcomes of new technologies hand in hand with the R & D programmes, the company compresses the interval between innovation and commercial returns.

ResearchCo has a bank of over 700 patents and patent applications worldwide, derived from its own R & D activities and resources. This is continually replenished by the ongoing innovation by the company. Working with customers, the company optimises return on intellectual property in either two ways:

- Licensing product designs, patents and know-how on a worldwide basis with major companies around the world, contributing to an increasing number of licensing agreements.
- Marketing and sale of products to international markets through wholly owned or joint venture companies dedicated to exploiting the latest technology in selected high growth market sectors.

The company's accomplishment in bringing breakthrough technology to the marketplace in a commercial form is illustrated by many of its recent successful innovations. One such innovation is the development of three-dimensional sound technique for PCs and consumer electronics, as described in the next section (6.3).

ResearchCo's expertise is based on a deep understanding and accumulated competencies in selected high-growth technologies in communications and electronics, medical and chemical, secure identification and multimedia. Inventions are driven by the needs and opportunities of the related markets and span many in-house activities in technological areas of electronics, optics, microengineering and magnetics. According to the company's long-term business plan, the generation of the company's future business will be derived from advances in these key technologies. The chairman explains in the company's annual report:

"Our principal markets are rapidly expanding around the world and all are characterised by a dependency on new technology to fuel their growth. This continues to create exciting opportunities for the company, as it increases the opportunities for licensing our technologies and selling our products and spurs our innovative efforts".

The company's customers are mainly blue chip organisations both within the UK and worldwide, the government departments such as the Department of Trade and Industry (DTI), the Ministry of Defence (MOD) and the European Community.

6.2.3 Human Resources

The company has an exceptionally skilled and qualified team of nearly 100 employees. Of them about 85 are scientists and engineers and the rest provides support services such as human resource management, IT, quality, health and safety and finance. Approximately 35% of its scientists and engineers have doctorates. The company's activities are founded on the creative output of its team of scientists and engineers. Because of the knowledge intensive nature of its activities, ResearchCo is dependent on the individual contribution that each employee makes to its success. The qualities that these employees possess are a critical success factor for the company's survival and growth in a very competitive market place. The company's recognition of its employees as critical components of its intellectual capital is evident in the company's annual report, which states:

"We continue to recognise that the company's success in its highly innovative and creative activities depends to an unusually high degree on each employee's personal contribution. Right across the management of new operations, the invention of new products, seeking and negotiating worldwide licensing agreements, ensuring quality standards in our products and specialist support roles, the skills of our people give us a distinct advantage".

The activities of scientists and engineers are focused on experimentation, gaining knowledge from their own experience and from the experience of others both within the group and across functions as well as from external sources. These activities are executed by linking technology and organisational structures with the cognitive bases to produce new knowledge. Scientists and engineers are organised into four technological functions within the company. Each of the functions specialises in a specific area of fundamental technology. An operations director and a marketing director head each function. The operations director has the responsibility for the day to day running of the function including, initiation of recruitment, training and the overall project management. The marketing director has the responsibility for the commercial activities of the function including new business development and customer relations. The two heads in each function form part of the senior management team of the company. They also form part of the key project teams for projects within their respective technological functions. These technological functions are closely coupled, with the aim of merging a number of independent technologies into new technologies in order to obtain valuable patents. Specifically, the development of the 3D sound technology needed technical expertise from all the other three functions.

It is evident that the company used formal dissemination processes such as meetings, forums and networks extensively to create and transfer knowledge. In addition, the project teams within ResearchCo communicated and operated through the informal, social processes of one to one chats, informal discussions initiated by interested parties and communities of practice for building on each other's ideas to mutual benefit. Thus, members tacitly absorbed and exchanged knowledge about the company's products, services, its markets, customers, competitors and suppliers. Knowledge continuously became embedded in the company's routines and culture.

The company has for years hired some of the best and brightest minds available. The challenge has been in creating an environment where the capabilities of those minds can be harnessed on a long-term basis, to produce a positive effect for the company. As with any other company employing knowledge workers, ResearchCo has a high staff turnover. Approximately 40% of the employee base joined the company within the past two years. This means a lot of new technical staff and a lot of company specific experience to be gained quickly. This also signifies a loss of intellectual capital, in terms of the accumulated knowledge and learning, with the effect of decelerating the technological progress.

A central feature of the human resource practices within the company is the acquisition and development of the required competencies. Efforts to develop the human capital – the cumulative tacit knowledge, creativity and motivation of employees - within ResearchCo

include training focused on future skill requirements, strategic rotation of staff between technologies and different projects, skill based pay, performance reviews, performance based promotions, group-based profit sharing schemes and employee stock ownership.

Although ResearchCo is trying to move away from its traditional command and control culture, the company is typified by a hierarchical structure within both the technological and support functions. There was evidence that greater responsibility is being encouraged throughout the company to empower employees in order to create stronger performance. Due to their senior positions within the company, the key project members have high levels of influence and power, with the responsibility for planning, controlling and improving their own work areas. Moreover, it was noticeable from the company's performance appraisal guidelines that the key project members are directed to apply principles that encourage employees at all levels to learn, be flexible and act according to the situation – in other words, to be self managing.

6.2.4 Collaborative Partnerships

ResearchCo has many communities of practice instituted by the scientists and engineers, which are both internal and external to the organisation. These personal relationships transcended the requirements of organisational structure and the commercial relationships and allowed knowledge to be constructed through the processes of social interaction and collaboration.

The intensity of the activities within the cross-functional work teams suggests that when it came to technical knowledge, expertise and know-how, scientists showed extreme willingness to share the knowledge they possessed with any person in the organisation. They felt that it was desirable to have the best possible knowledge about available solutions to problems.

The company has entered into agreements with many leading players from the games industry for technological partnerships intended to augment the internal knowledge. For example, the engineers work in continuous consultation with many companies from the interactive entertainment industry across the globe to ensure that ResearchCo's 3D audio technologies are optimal for their purpose, enabling additional audio functionality to be included in games. ResearchCo is also a member of the Interactive Audio Special Interest Group that enabled ResearchCo's scientists to gain knowledge regarding the status of industry standards for audio technology as well as to actively influence the development of standards.

The next section describes the development project for the 3-D audio technology.

6.3 The Project

The project described in this second study is the development of 3-D audio technology (interchangeably referred to as 'the technology') carried out by the 'Multimedia' function within ResearchCo. The technology is new to the company as well as to the industry. For this reason the project represents radical innovation.

6.3.1 Creating Value through Breakthrough Products

The development of the 3-D audio technology started its life 10 years ago as a corporate funded R & D project. A result of research and development into the human spatial hearing process, the technology replicates audio environments using computer software. It mimics the acoustic processes involved and simulates the effect of hearing sound in three-dimensional space by carefully modelling sound energy distributions from all spatial positions around the human head. This data is then transformed into a mathematical algorithm. The innovative algorithm is integrated with multimedia processors to provide high quality audio effects. In 2001, the technology won the UK's most prestigious honour for innovation, the MacRobert Award given by the Royal Academy of Engineering.

One of the most widespread applications of the technology is for interactive computer games, which needed to integrate higher levels of audio performance to complement the 3D graphics already available in the multimedia market. The technology allowed the developers of interactive games to create a sonic arena that could give the player solid, actionable information as experienced in real life when objects move around the listener such as bees buzzing around the head or bullets flying past the ear.

The technology is licensed to leading manufacturers of audio chips that are used in PCs. The audio chips are used on soundcards, motherboards, PCs and notebooks manufactured by major companies including Dell, NEC and IBM among others to provide the audio experience of 3-D sound in computers. The company recently announced that they support over 12 million PC audio chips currently in circulation worldwide. Additionally, the company's total licensees now supply over 70% of the single chip audio market.

6.3.2 Creating Value through Continuous Innovation

The project team originally developed the technology to enhance classical music recordings. The idea was to record the orchestral performance by using an artificial head with microphones where the ears are. This technique produced recorded 3D sound, invoking the all-enveloping experience of music in the concert hall. With the proliferation of multi media computing, the

company identified a new opportunity in the PC market and worked to extend the technology to take advantage of this new market. Thus the project team initiated further research and development to model the human spatial hearing process in order to apply the technique to computer sound, by synthesising electronically what the head and ears do acoustically.

A critical feature in 3-D sound processing is the library of 'Head Related Transfer Functions' (HRTFs), that lies at the core of all the algorithms and defines how sounds from various directions interact with the human head and ears. HRTFs can be measured either from a commercially available artificial head or from human volunteers. According to the project's chief scientist, the basic features of incorporating 3D sound cues into a recording have been in use for some time. An early patent for this concept has been filed in the US in 1927. By creating a microphone having the same dimensions as an average head and ears, it is possible to make sound waves undergo the same acoustic modifications that they do with a real head-and-ears combination before reaching the microphones. Consequently many of the important 3D sound cues become incorporated into the recording and such recordings provide dramatic 3D effects when auditioned over headphones. However the project team found that the resultant data were not accurate enough for effective digital 3D sound synthesis. To overcome this, the team set out to devise a spatially accurate, proprietary artificial head system.

The team's strategy for producing an accurate artificial head system was to create and gradually refine a physical ear structure by empirical means. Careful observation and study of the physiology of the outer ear system guided this process. A series of successive iterations - nearly 35 versions - was made until a satisfactory ear structure was achieved. In parallel with this work investigations were made on a variety of associated features. These features included, among other things, the evaluation of the sound-wave reflections and the creation of a spatially accurate ear canal system. This phase for developing the proprietary artificial head alone took nearly two years of the team's effort.

In the next phase, the team used a digital cloning method to engineer ear pairs together with integral auditory canals. The digitised ear system was constructed using a CAD/CAM system because manual methods were not possible due to precision required. HRTFs from these digital ears are incorporated into the 3D sound algorithms that appear in computer sound cards and consumer equipment.

Thus, the project involved a series of different tasks, each with its own different solution, until success in the final technology was achieved. The domain-relevant experience accumulated by

the project's members over the 10-year history of the technology's development resulted in many creative responses in terms of the applicability of the technology.

Since its innovation, the team has developed many variants of the core technology in order to expand the capabilities of the 3D positional audio. The technology has evolved from its original form as developed for the music industry, and then as a single licensed product to the semiconductor industry, to one that is available in many different scopes. The technology's portfolio of intellectual property includes more than 55 patent filings worldwide. Substantial further opportunities are seen for the technology in the rapidly growing range of new consumer entertainment products, such as DVD, mobile phones and for Internet related products.

6.3.3 Challenges Faced by the Project Team

ResearchCo operates in intensely competitive markets with rapidly changing technology. Frequent upgrades in the computing hardware and software, gaming applications and the industry standards for audio rendering specifications are common in the industry. These changes made the development process dynamic, necessitating the continuous re-evaluation of assumptions and the decisions that depended on them.

Time to market was a critical factor in the development of the 3D sound technology. Since there were other companies who were also developing 3D sound cards and reverberation engines, the project team focused on a solution designed to integrate the industry standard with new audio options and better sound quality. In a press release by the company, the developer-relations manager commented:

> "We are pleased to be the first company that implemented the new guidelines as prescribed by the 'Interactive audio Special Interest Group'. By implementing the new standard and integrating its enhancements into our technology at such an early stage, we have provided [game] developers with a platform to incorporate the next level of realism into their games for the benefit of the whole gaming community".

ResearchCo faces a severe shortage of personnel necessary for its development work, caused by the rapid turnover of staff and the need for specialised skills. When a project's development spans a number of years as in the case of the 3-D sound technology, personnel turnover leads to a reduction in the collective, accumulated knowledge, causing a loss of synergy developed over the course of the project.

The cost of the research and development process was high. Salaries comprised the major cost of the project. Although the salaries of scientists and engineers were not abnormally high, the project required a number of scientists working on various aspects over a period of 10 years. The project also required sophisticated scientific equipment with high costs.

The research was inherently a high-risk process, as only a few experiments out of many did succeed. However, the team's failed experiments often formed the basis of new experiments and added to the learning process.

Having provided a description of the company and the project, the next section and its sub-sections discuss the findings from the second and final case study of this research and examine the propositions

6.4 Examining the Propositions

Following the same methodology and the level of analysis as for the first case study, this section reviews the project at ResearchCo in terms of the propositions of the theoretical model to provide insights into how intellectual capital factors contributed to value creation. As in the case of ConsultCo, efforts were taken to build a coherent interpretation of the data. The propositions are examined with illustrations from the company documents, observations and interviews. Although the technology took 10 years to develop, the focus of this analysis is on the two-year period commencing from the initial licensing of the technology to its full commercialisation. This period provides sufficient data to support the theoretical model and allows the researcher to study the dimensions of intellectual capital within an innovative context.

For the purpose of examining the propositions it was decided to interview the 5 senior managers (the composition of interviews detailed in Table 4.5 in Chapter 4), who hold key positions within the project team and who have a holistic understanding of the project and the company. A semi-structured interview schedule was used for the formal interviews. Several informal interviews were conducted to clarify issues, both with the key project team and with others who were involved in the project. The overall strategy of data analysis was deductive, using the theoretical framework as described in Chapter 4 (section 4.5).

Sub-sections 6.4.1 to 6.4.3 discuss the outcomes for propositions 1 to 6 and their indicators as justified in Chapter 4 (section 4.5). The case evidence is then summarised in a tabular display for each indicator in tables 6.1 to 6.6. As indicated in the tables, each outcome is supported by a combination of project and company documents, project members' own interpretations of events and processes and the field notes made from the researcher's observations.

Sub-section 6.4.4 provides an overview of the outcomes relating to the propositions. As discussed in chapter 5 (sub-section 5.4.4), in order to illustrate the relative contribution each construct made to the value creating process, a 5-point Likert type scale was used where the strength of the evidence was rated from very weak to very strong. Table 6.7 sets out the 5-point scale and table 6.8 summarises the strength of evidence relating to each construct.

6.4.1 Examination of Propositions Relating to Human Capital

This sub-section examines the factors in terms of the three main propositions and three sub-propositions that relate to the intellectual human capital. The three main propositions investigate the types of knowledge, levels of knowledge and creativity, while the three sub propositions are concerned with the antecedents of creativity.

Proposition 1 - Types of Intelligence

There are two main types of intelligence that are associated with the innovation process. They are (a) technical knowledge that is relevant to the task or problem, and (b) social, political and interpersonal knowledge that is specific to the organisational context.

Both types of knowledge are characterised by procedural knowledge (know-how) that enables the combination and recombination of declarative knowledge (know-what).

Technical Knowledge (Domain Relevant Knowledge)

The key project team at ResearchCo consists of 5 members. With the exception of the managing director, the key members belong to the same functional department within the company and hold the titles of marketing director, operations director, the chief scientist and developer-relations manager. All key members hold doctorates. Of the 5 members, 3 (the chief scientist, operations director and customer-relations manager) have multimedia and audio technology expertise, while 2 members (managing director and marketing director) have business development expertise.

The mean age of the key members is 45.4 years (in contrast to the mean age of 38 for the whole company) with a minimum of 36 and a maximum of 55 (Analysis in Appendix C). In contrast to the high staff turnover rates within the company, the key project members have spent an average of 9 years working on the project with a minimum of 6 and a maximum of 10 years. They have a total of 46 years of experience within the project. Thus, the availability of highly developed skills to apply to problems provided the team with the ability to make informed choices across a range of technological possibilities creating the opportunity for innovativeness.

The chief scientist who was the project leader oversaw the total programme. The key project members, with the exception of the marketing director, are also the founder members of the project and are the sources of project specific technical knowledge that is proprietary to the company. The marketing director joined the company and the functional department halfway through the project and helped the team stay attuned to the market needs during the development period, which focused and accelerated the technical development. His market specialisation enabled the team to secure an early licensing deal with a PC manufacturer, which brought in much needed investment funds to further develop the technology. The managing director championed the project and in the early years clarified the vision and the objectives of the technology as well as negotiating and allocating funds and resources for the project. The contribution of the key project members was of central importance to the team's ability to continuously improve the audio libraries and file 55 patents for the technology.

In replicating the audio environments using computer software, the project team has merged different disciplines and technologies to create whole new portfolios of algorithms and associated patents. According to the operations director, software design was a highly individual effort and therefore the members, for the most part, worked independently. However, the scope of the 3D audio technology was not confined to a single person's portfolio of skills and expertise and therefore the development process required the co-ordination of the specialised skills of each member. The team's research into the mechanisms by which sound energy is transformed into nervous activity and developing the 3D sound technology required integrating the scientific know-how of the disciplines of physics, advanced mathematics, chemical engineering and biophysics and formed the core knowledge of the project team. Every member of the team has his or her unique speciality, evidenced in the many scientific papers that the members have produced. They continuously updated their knowledge through scientific conferences and subscriptions to technical journals and tapped the knowledge of others to solve problems. Thus the project team carries a variety of skills and knowledge bases that are unique to the technology and the company, spanning from programmers with analytical skills to designers with artistic skills.

In addition to drawing on the knowledge within the function, the project team needed specialist knowledge and experience of members from other functions within the company. For instance the time sheets showed that several scientists and engineers have been loaned to the project from other functions from time to time.

Social, Political and Interpersonal Knowledge (Context Specific Knowledge)

In addition to the scientific work, the key project members were concerned with the direction, motivation, integration and control of the project's performance. They described their management duties as: representing the project at various internal and external meetings [the chief scientist]; resolving any differences between project members [operations director]; co-ordinating the tasks between the customer and the project team [customer relations manager]; providing customer perspectives [marketing director] and managing shareholder commitment [managing director]. The researcher's observations show that the key members facilitated the implementation and the commercialisation of the technology in terms of organising the diverse activities of the project, marketing, licensing and maintaining the on-going relations with the many developers of gaming software. Thus, it was evident that the key project members possessed a high level of social and political influence both within and outside the firm, leading the innovation to business success.

It appears that the key project team was influential in reshaping the development process to take advantage of the changing market opportunities. As noted previously, the development of the technology took 10 years, involved high costs and needed the long-term commitment and support from the top management and related stakeholders. During that time the technology underwent substantial changes in scope. For instance the technology has evolved from its original form as developed for the music industry to one that is widely used in interactive games. Furthermore, the funds and commitment to the changing needs of the project were secured "by clearly articulating the sense of purpose and focusing on the strategic benefits, which were important to the stock market" [managing director]. Thus the context specific knowledge and the experience provided the senior managers with an implicit mental model of how value was created in their business. However, articulating this value-creating path was an iterative process, learned over time through trial and error and through discussion and argumentation both at the project level and at the company level, as discussed further under proposition 2.

Procedural Knowledge

The team's ability to use the existing facts (declarative knowledge) with task specific, if-then rules (procedural knowledge) that relate to implicit reasoning, enabled them to evaluate solutions to complex problems, whether they related to technology or markets. For instance, the team created new products from the technology by undertaking a deliberate search for new ideas and exploring the many possibilities using their scientific and market knowledge and the tacit, task-specific rules. For example as noted above, the team originally developed the 3-D audio technology to enhance classical music recordings, by creating the surround sound experience of

music in the concert hall. With the proliferation of the multi-media computing and recognising that the project's technology could be applied to many other situations the team has made the technology evolve from its original form to one that is available in many different scopes. Thus, by applying their knowledge and experience of positioning audio streams in three dimensions, the team extended the technology and produced novel responses to take advantage of the PC and the new interactive gaming market.

In addition to the team's tacit if-then rule based knowledge that was required to accomplish tasks, the many project manuals revealed explicit procedures describing project related actions in step by step sequence. This was in line with the company's policy of maintaining formal procedures that ensured decisions were documented as far as possible to keep up with the technical evolution of the project.

In summary, the examination of proposition 1 reveals that at ResearchCo the technical knowledge to develop the technology and the context specific, social and political knowledge to implement and commercialise the technology were highly pertinent to the success of the innovation. As described above, the project involved people with technical competence, such as the chief scientist who led the innovation and people with the necessary power within the organisation and the understanding of the importance of the technology, such as the managing director who championed the innovation. The importance of the task specific technical knowledge was further evidenced in the customer-relations manager's suggestion that the lack of people with technical capabilities delayed the problem resolutions.

It was evident that all members used both the declarative knowledge that came from the education and training and that formed part of the broad domain skills and the procedural knowledge that consisted of if-then rules, which were both tacit (an individual's internal processes) and explicit (procedure manuals). As described above, by grasping the essence of the technology, the members were able to determine potential applications for the technology and developed novel responses to the changing market needs.

Table 6.1 presents the summary of case evidence relating to the indicators of proposition 1, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Technical knowledge (Domain relevant knowledge)	• Experience in a specialised domain	Scientific knowledge through research into 3-D sound waves	Documents, interviews
	• Special skills	Know-how in audio sound synthesis, filing of related patents	Documents, interviews
	• Number of years in the company and the project	Deep knowledge of a defined scientific area	Documents, interviews
Social, political and interpersonal knowledge (Knowledge about the organisational and industry context)	• Level of involvement in the project	Involvement in the project at a high level	Documents, observation
	• Personal characteristics	Social and political influence to secure funding and commercialise the technology	Documents, observation
Combination of procedural knowledge with declarative knowledge	• Task specific rules	The use of procedure manuals	Documents, interviews
	• Intellectual skills of knowing how to do something	Tacit skills to explore new and different scopes of the technology	Documents, interviews

Table 6.1: Summary of Evidence Relating to Types of Intelligence in Proposition 1

Next, proposition 2 is examined in respect of the levels of knowledge.

Proposition 2 - Levels of Intelligence

There are two main levels of intelligence that affect the innovation process. They are (a) individual intelligence that is domain specific and (b) organisational intelligence that is context specific.

Intelligence at the Individual Level

As described above, the interviews and observations revealed that the project benefited from the expertise of individuals who had a deep knowledge of a defined area. The education, training, skills and experience of the individual project members encompassed the scientific understanding of the 3D sound technology and the insights about the changing market needs. Their unique ability to recognise the technical and the commercial opportunity formed the basis of the company's technological capabilities.

Observations revealed that the project members had a tendency to hold knowledge tacitly in their heads rather than explicitly on paper or in computer databases. For instance, the highly individualised nature of the project's knowledge was evident every time a team member left the company. In this sense, in line with the company procedures, the project team maintained formal processes in order to ensure decisions and progress were well documented. However, according to the chief scientist, it was not possible to explicate most of the knowledge due to two main reasons: firstly, it took too long to codify every piece of knowledge acquired through cumulative experience. Secondly, it was impossible to articulate much of the problem-solving knowledge that operated unconsciously in the background in the heads of individuals. Despite these limitations, it was the tacit knowledge of the individuals that was closely associated with the development tasks.

Most project members described the nature of their work as non-standardised and based on experimentation. Their specialisation meant that the scientists and engineers approached problem solving primarily at an individual level rather than at the team level. However, creation of value by transforming knowledge into marketable products required a range of knowledge that was gained through combining the specialised knowledge of many individuals. Therefore, although the knowledge was held individually, it was linked and co-ordinated to form the basis of the company's technological capabilities.

Intelligence at the Organisational (Collective) Level

On average the key project members have been employed at the company for 13 years with a minimum of 6 and a maximum of 20 years. All members agreed that the nature of the project team's pool of knowledge is experience based and was created through continuous experimentation. For instance, the long development period of the 3D audio project implies that the technology contains a vast element of firm specific tacit knowledge, making it difficult to imitate by competitors.

The complex nature of the 3D audio technology meant that much of the problem solving depended on the creative combination of different skills and perspectives within the function as well as across the organisation. Whilst the team consisted of members from different specialised areas, it focused upon their shared contributions to the development process. This required systematic and organised application of the team's knowledge that was stored within the individual project members. In addition, the team also drew on expertise from many different professional functions within the organisation including legal, intellectual property management, marketing, sales and finance for commercialisation of the technology. Thus, it was

the accumulated, collective in-house knowledge within the company that created the distinctive capabilities to transform the technology into marketable products.

Accessing the breadth and depth of knowledge needed for the technology and integrating that knowledge was achieved through the company's structure of authority and communication that was both formal and informal. For instance, the key project members influenced and directed the integration of specialised knowledge activities through "investigating gaps and overlaps in the technology arrangements"[the chief scientist], "co-ordinating the individual programmes and integrating them into the overall project plan"[operations director] and "linking the technology with market needs"[marketing director]. In the same way, the company made use of the advances in the information technology to assimilate, store and communicate the explicit knowledge through the company's Intranet and other electronic databases and networks.

It was evident that ResearchCo used meetings, forums and informal discussions extensively to create and integrate knowledge through the processes of social interaction and collaboration. For instance the regular "lunchtime" technical workshops on selected themes where the staff gathered in a comfortable room with their sandwiches and coffee, made space for exchange of knowledge. These workshops gave scientists the opportunity to discuss their projects' progress or the technical problems they are faced with, often receiving valuable comments from their peers in other functional groups, thus tapping into the collective wisdom of the organisation. This long-term and continuous interaction created a shared meaning between the team members and embedded the knowledge in the company's routines and processes.

The researcher's observations show that the project members had formed many relationships that had developed into communities of practice within the scientific community both within and outside the organisation. The members were able to generate and hold knowledge collectively as part of a social activity within these tightly knit groups with a shared goal.

In summary, the empirical evaluation of proposition 2 reveals that the development of the 3D audio technology needed high levels of technical knowledge. The complexity of the project meant that it needed a wide range of specialised knowledge of a number of individuals. It was evident that the competencies were not confined to those of an individual but came from interdependent groups where tacit, firm specific knowledge that was accumulated through experience was of central importance. For this reason the development of the technology into a marketable product to create value relied heavily on the effective integration of the wide array of knowledge. It was evident that formal and informal processes were employed to create a shared meaning among the members in order to embed knowledge into the company's routines

and processes. The ability of the key project members to combine the specialised knowledge of the individuals to create new potential of the technology formed the basis of ResearchCo's strategic capability. However, as with case study one, the knowledge intensive nature of the project meant that the effectiveness of value creation depended on there being a stable collection of individuals within the team.

Table 6.2 presents the summary of case evidence relating to the indicators of proposition 2, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Individual intelligence	• Education, training, experience and expertise	Tacit knowledge Ability to recognise opportunity	Interviews, documents Documents
Organisational (collective) intelligence	• Employee tenure • transference and diffusion mechanisms • Collective learning	Firm specific proprietary knowledge Formal and informal interaction to create a shared meaning A social outcome, communities of practice	Interviews, documents Interviews, documents Interviews, observations

Table 6.2: Summary of Evidence Relating to Levels of Intelligence in Proposition 2

Next, proposition 3 is examined in respect of the individuals' creativity within the organisation.

Proposition 3 - Creativity

Individual creativity is an antecedent of innovation.

The project is next reviewed in terms of the creativity propositions in order to ascertain the extent to which the project reflected organisational creativity. The extent to which the indicators were present within the project team is examined below.

Creativity as an Antecedent of Innovation

The radical invention of the 3D sound technology, which has, as reported by the trade's press, become the de facto standard for 3D audio software in PCs, demonstrates creativity in terms of the new and useful ideas generated by the project team. For instance, according to the chief

scientist, the development of the commercial product was the result of "the team applying creative thought to little known fundamental scientific processes".

The key project members described their creative activities in terms of new and useful ideas that led to the innovative outcome. These included "scientific experiments that produced several patents"[the chief scientist], "identifying the vision and the objectives of the technology"[managing director], "identifying unexplored opportunities in the various markets"[marketing director] and "breaking away from pre-conceived ideas when interpreting test results"[customer relations manager]. Thus the project members produced creative work in different domains and at different stages of the new product development. The descriptions of the activities suggest that the creative ideas were in both science and business.

The project's creativity was further confirmed as a contributory factor to innovation when the founder members of the project were awarded the UK's most prestigious engineering prize, the MacRobert award from the Royal Academy of Engineering. The award is made annually for outstanding innovation in engineering and recognises the importance of creative action. According to the chairman of the judging panel:

"The technology is an excellent example of software's enormous role in contemporary engineering. The team richly deserves the award. Their in-depth research and development has produced truly astonishing results, demonstrated by their success in the global market".

The researcher's observations show that in addition to the novelty of the algorithms that are based on the science of acoustic transfer functions, the team displayed its creativity by identifying a wide variety of useful applications ranging from interactive computer games to external noise cancellation in mobile phones. It is therefore apparent that the project reflects creativity and that organisational creativity is an antecedent of innovation.

Proposition 3a - Cognitive Characteristics as an Antecedent of Creativity

Individual creativity is influenced by two cognitive characteristics: (a) when there is task domain intelligence (declarative knowledge) and (b) when there is flexibility in combining rules (procedural knowledge).

The previous discussions show that the creative activities of the project members were based on the expertise in their respective fields. It was evident that the expertise of project members provided memory for factual (declarative) knowledge in a specific field. The expertise also related to the technical proficiency gained by formal and informal education and the familiarity

with the work of the domain. For instance the chief scientist demonstrated creativity in the scientific field while the marketing director demonstrated creativity in the identifying of market needs for the technology.

The study showed that in addition to the visible domain specific experience, the project members displayed tacit thinking skills that were experience based. Due to the long tenure of the key project members, there was a possibility that these ingrained thinking patterns have become resilient and rigid, thereby becoming core rigidities. However it was evident that the team demonstrated their cognitive flexibility by continuously employing problem-solving skills to move in new directions. For instance, as noted previously, the technology evolved over time mainly due to the new perspectives taken by the project team to take advantage of the changing needs of the market. By critically evaluating their options, the team discovered many new applications and scopes for the 3D audio technology. It was also noticeable that the problem-solving skills were tacit and therefore idiosyncratic to the particular individuals.

The cognitive skills as examined by the sub-proposition 3a determined what the project members were capable of achieving in a particular domain. However, as described in chapter 4 (sub-section 4.5.4), what the individuals will actually do is determined by the level of motivation that can be either intrinsic (resides in a person's own personality) or extrinsic (caused by external inducement such as rewards and recognition). While extrinsic motivation will be examined under proposition 4 – enabling conditions, the next sub-proposition examines the intrinsic motivation and personal orientation of the project members.

Proposition 3b - Behavioural Characteristics as an Antecedent of Creativity

Individual creativity is influenced by two behavioural characteristics: when individuals have (a) a high intrinsic motivation and (b) personal orientation toward creativity.

The discussions and observations show that the project members possessed a high level of intrinsic motivation. For instance, all of the key members considered the project work as challenging and providing intellectual stimulation. They all reported deep interest and personal satisfaction in the work as well as a feeling of accomplishment. Furthermore, the long tenure of the key project members signified high involvement and absorption in the project, which had an impact on creativity.

The company procedures indicated that members were allocated tasks that coincided with their skills and interests in order to create a mutual purpose and a sense of positive challenge in the work. Furthermore, the continuous experimentation and the process of searching for new solutions led to domain-relevant learning that contributed to an increase in intrinsic motivation.

It was also evident that the creative activities of the project (as described under proposition 3) were influenced by the personal orientation of the project members. For instance, all interviewees rated highly the willingness to take risk, enjoyment of experimentation and the readiness to entertain new ideas. In the same way, gaining peer acceptance was rated low by all interviewees, indicating independence of judgement and a lack of concern for social approval.

The work environment can influence an individual's motivation and thinking skills that impact on creativity. For this reason the next sub-proposition examines the characteristics of the project environment.

Proposition 3c - Organisational Characteristics as an Antecedent of Creativity

Individual creativity is influenced by two situational characteristics: (a) when the problem is novel, unfamiliar or heuristic and (b) when an intelligent approach to problem solving is expected and valued.

As noted previously, the project members stated that their work was non-standardised, with no clearly defined solutions or goals. The nature of their work displayed distinctiveness that is characteristic of knowledge-intensive work. This distinctiveness meant that the project had a high degree of task novelty in terms of the work that the members were doing and the result of their work. For example, the project team found task novelty in the development of the commercial products from "the little known fundamental scientific processes"[the chief scientist] that served "the new market needs created by the advances in technology"[managing director].

The heuristic nature of the project meant that the members were required to produce creative responses until success in the final technology was achieved. In searching for solution paths the team members discovered many variants and applications of the technology.

Consistent with the above observation all interviewees stated that an intelligent approach to problem solving was valued and expected of the project team. The interviewees also reported that a spirit of co-operation was available to the project team. Thus, ResearchCo has an organisational context that is conducive to creativity and innovation. This orientation is permeated in the support available to the work groups and the freedom enjoyed by the scientists and engineers.

In summary the examination of proposition 3 and its sub-propositions revealed that the project members' creative activities resulted in the innovative 3-D audio technology. It was evident that the cognitive and behavioural characteristics of the members influenced the creative outcomes. It was also evident that the work environment in terms of the task novelty and expectations of intelligent approach influenced the creative behaviour.

Table 6.3 presents the summary of case evidence relating to the indicators of proposition 3 and its sub-propositions together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Creativity (Creative outcomes of project members)	• Novel and useful solutions to problems	Application of creative thought to little known scientific principles Identification of a wide variety of useful applications of the technology	Interviews, observation Documents, interviews, observation
3(a) Cognitive characteristics (domain knowledge and procedural knowledge)	• Deep specialist knowledge • Intellectual skill of knowing how to do something	Technical proficiency Tacit and idiosyncratic problem solving skills	Documents, interviews Documents, observation
3(b) Behavioural characteristics	• Intrinsic motivation • Personal orientation	High involvement in the work A feeling of accomplishment Readiness to entertain new ideas Independence of judgement	Documents, interviews, observation
3(c) Organisational characteristics	• Task novelty • Organisational orientation	Distinctive and complex technology Spirit of co-operation Intelligent approach expected	Documents, interviews, observation

Table 6.3: Summary of Evidence Relating to Creativity in Proposition 3

The creativity of individuals can be enhanced or inhibited by the organisational structures such as the working atmosphere and management practices. For this reason organisational capital dimension is examined next, through propositions 4 and 5.

6.4.2 Examination of Propositions Relating to Organisational Capital

The organisational capital dimension represents the institutional systems and the situational context that reflect how innovation and creativity are facilitated within the company. In this sub-section, the two propositions relating to enabling conditions and situational factors are examined with the intention of establishing the internal contextual setting of the company.

Proposition 4 - Enabling Conditions

*Individual creativity results in innovation under four main enabling conditions: (a) when there is **opportunity for creative expression** (b) when there is an **absence of constraints** (c) when there are **adequate resources and support to develop ideas** and (d) when there are **incentives that enhance intrinsic motivation.***

The key project members at ResearchCo described the work environment of their project in terms of its enabling conditions that contributed to the project's outcome. The responses show that the project members enjoyed very high levels of opportunity for creative expression. All members said that they had high operational autonomy and the requisite power to act. For example, it was up to the individuals to allocate their time between the lab work, writing scientific papers and attending seminars and conferences. In the time sheets, these were simply charged to the project as direct costs, without the need to distinguish between the categories of tasks, thus demonstrating the management's attempt to allow flexibility. The leadership support was evident in the way the key project members supported the work of the individuals and the entire project team through clear planning, feedback and two-way communication. For example, it was evident during team meetings that all members were encouraged to voice their views and concerns.

The researcher's observations reveal that there was a certain amount of formalisation of processes within the administration functions of the company. For example, a request for travel or a purchase of high value material had to go through a lengthy process requiring signatures. However, the members stated that they did not feel significantly affected by the administrative bureaucracy. As noted above, the team felt that they have the autonomy to make project relevant decisions. In the same way, although members experienced excessive workloads at times, this was not seen as a de-motivating factor, but rather as a time management issue. Thus, the negative effects of constraints within the work environment in terms of formalisation of processes, frequent interruptions and at times excessive workloads seem to play a relatively less prominent role in affecting the creativity and intrinsic motivation of project members. Consistent with the above view, the members indicated that the company does not suffer from organisational inertia and resistance.

It was evident that ResearchCo's senior managers provided sufficient resources to encourage the development of new ideas. For instance, the project memebers stated that they have a high level of support in terms of adequate time for proper experimentation as well as funds, information, training and IT tools that were required to carry out the project tasks. As ResearchCo has been a subsidiary of a large multinational, it was not unusual to find that advanced IT tools such as teleconference facilities, the Intranet and computer aided design (CAD) systems were commonly used. The Intranet was used to store and disseminate information such as procedures, meeting minutes, project schedules and discussion forums, replacing the traditional paper based means. Many members recognised these ICT tools as indispensable means of transferring knowledge. All the members stated that the company recognised the need for adequate time for exploring ideas and potential solutions rather than accepting the first feasible option. However, many members said that they have limited financial support and time for their pet projects that were ancillary to the main tasks.

As noted previously the informal discussions and communities of practice provided the project members with constructive feedback and shared team experience, facilitating the exposure to other potentially relevant ideas. Unsurprisingly, all members found their co-workers very stimulating.

ResearchCo operates many schemes for rewards and incentives that encourage the outstanding contributions by members. For instance the bursary scheme for patent requests lodged with the Patent department, monetary awards for publications in journals and the recognition received for creative ideas were identified as high motivating factors by the project team. Documents show that the company also has stock options and profit sharing schemes to encourage the retention of employees. During the discussions, a few members recognised rewards as being on a "quid pro quo" concept – no actual reward scheme but self-fulfilling as innovation will result in a stronger business.

In summary, examination of proposition 4 indicates that the project members enjoyed a very high level of opportunity for creative expression in terms of active communication of ideas, operational autonomy and the leadership support to address problems. However, evidence suggests that the team had a moderate level of support in terms of absence of constraints. Although the members reported that they were highly motivated and that they did not experience organisational resistance to creativity and innovation, they experienced excessive workloads at times and high formalisation of processes, indicating the presence of some elements that can undermine creativity. Similarly, members described the availability of

resources such as time and funds as moderate while the availability of training, information and IT as high. It was evident that the company had many schemes to recognise and reward creativity and innovation, indicating a high level of support for creativity. As described previously, the members reported that the lack of some enabling factors in the working environment did not affect their motivation or constrain their creativity. However, it was not clear if the availability of these factors would have substantially enhanced the creative performance.

The table 6.4 presents the summary of case evidence relating to the indicators of proposition 4, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Opportunities	• Autonomy • requisite power to act • leadership support to address problems • constructive feedback • shared team experience • stimulating co-workers	Very high Very high Very high Very high Very high Very high	Interviews, observation
Constraints	• Lack of motivation • Lack of control • Interruptions • excessive workload • formalisation of processes • organisation resistance and inertia	Very high motivation High autonomy Some interruptions Excessive at times High but not excessive Very low	Interviews, observation, documents
Adequate resources	• Funds • Time • Information • IT	Adequate Satisfactory Satisfactory High	Interviews, observation, documents
Rewards and incentives	• Recognition • stock options • profit sharing • Bonus schemes	Very high High High High	Interviews, observation, documents

Table 6.4: Summary of Evidence Relating to Enabling Conditions in Proposition 4

The work environment is further explored in terms of the organisational context, through proposition 5.

Proposition 5 - Organisational Context

Organisational innovation is influenced by two situational conditions: (a) high organisational orientation to innovation and (b) when situational factors favour the expression of innovation.

Three main aspects demonstrate ResearchCo's orientation to innovation. Firstly, as described in section 6.2, the company's commitment to innovation is evidenced in its history that dates back to the 1920's. Furthermore, according to the company's annual reports, its strong R & D capability has facilitated continuous invention, through which the company has sustained growth and produced many spin-off technology companies.

Secondly, the company has cultivated a capacity for organisation-wide problem solving. For example, through cross-functional involvement and various forms of other inter-organisational networking to develop many variants of the technology, the project members encouraged knowledge and experience from diverse perspectives and utilised the creativity of all individuals associated with the project. In addition to the scientific problem solving, the efforts to commercialise the technology involved the close co-operation of many functions such as quality assurance, legal, finance and marketing. Thus, the project team was able to acquire and accumulate the technological capability and combine new and existing knowledge to develop the technology and related distinct competencies.

Thirdly, the company actively nurtured an innovative environment by recognising and encouraging the individuals' contributions. For example, all of the project team indicated that the company has a sense of pride in its members. This was evidenced in the company's annual reports, which explicitly state that the company valued the personal contribution of its skilled employees. The discussions also indicated that the company placed a high value on innovativeness. This was evidenced in the challenging work, peer group support and managerial encouragement that were available to the members as discussed under sub-proposition 3c.

Innovation was also influenced by ResearchCo's formal approach to innovation that strengthened its ability to recognise and benefit from the changes in the business environment. For instance, the project documents show that, during the 10-year long development period of the technology the key project members had to make many choices about its path of progress, accepting risk and exploring and selecting the most appropriate responses to market triggers. Thus, the company's consistent investment in R & D provided a learning process and a strong base of intellectual property rights (IPR) through patenting of its technology.

The great deal of experimentation and a series of problem-solving loops during the innovation process meant that the team needed to tolerate failure and at the same time learn from past mistakes. This process improved experiential learning and added to the company's technological competence and the firm-specific knowledge, which is an essential feature of value creation through competitive advantage.

It was evident that the senior management has put in place many organisational systems and procedures that encouraged innovation. The key project members played a vital role in championing and shaping the innovation with clearly articulated overall project goals. The vision of the key project members and their participative leadership style guided the creative individuals working on the project. Their actions manifested in the shared values, assumptions and beliefs, which influenced the innovative behaviour of the employees. For instance, as noted above, ResearchCo's culture is one that displays openness to ideas from outside. The shared team experience created by the networks within and outside the company provided many opportunities for experiential learning. The company has flexible structures and procedures in terms of high employee autonomy and loose job descriptions. However, the company has not yet completely moved away from the hierarchical structure and the centralised decision making that it inherited from its past.

In summary, examining proposition 5 reveals that ResearchCo's organisational context explicitly recognises and supports its distinctive competencies to effect innovation and thereby value creation. The company has a strong orientation to innovation where research and development is considered as an investment in learning as well as in strategic positioning.
It is clear that the vision of the key project team identified future opportunities and actively influenced the innovation process to affect the successful outcome. The company maintains a supportive and innovative culture. The evidence shows that the key project team has put appropriate processes in place to balance the autonomy of employees with responsibility, for example, by articulating the project goals.

Table 6.5 presents the summary of case evidence relating to the indicators of proposition 5, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Organisational orientation to innovation	• Commitment to the innovation process	Strong R & D capability, continuous invention	Documents, observation
	• A capacity for organisation-wide creative problem solving	Open to ideas from many perspectives	Documents, interviews, observation
	• Sense of pride in the organisation's members	High recognition of members' contribution	Documents, interviews
Organisational structure	• A formal innovation approach	Strategic approach to innovation, high investment in R&D, protection of IPR	
	• Learning capabilities	Open flow of communication, experiential learning	Documents, interviews, observation
	• Management practices	Supportive management style, clear project goals	
	• Culture norms and values	Innovative ways of addressing problems	
	• Flexible structures and procedures	High autonomy, loose job descriptions, however, hierarchical structure	

Table 6.5: Summary of Evidence Relating to Organisational Context in Proposition 5

The propositions 1 – 5 discussed so far examined the internal dimensions of the company's intellectual capital. The next sub-section examines the external dimension, which is collaborative intelligence that influences the value creation process.

6.4.3 Examination of Proposition in respect of the Relationship Capital

This sub-section examines the sixth and the final proposition of this research model that relates to relationship capital. The essence of relationship capital is the knowledge embedded in collaborative relationships external to the firm.

Proposition 6 – Collaborative Business Intelligence

Innovation is influenced by collaborative business intelligence in the form of: *(a) collaborative relationships with* **business partners** *and (b) collaborative relationships with* **customers**.

Collaborative Relationships with Business Partners

ResearchCo's key technologies for 3D audio have been developed internally using in-house competencies. However, the company complimented its internal R & D capability by absorbing new ideas and perspectives from external partners, using collaboration as an opportunity to learn

from external sources. For this reason, the company participated in many research consortia comprised of multi-firm collaborations funded by the government and the EU, such as the EU funded ESPRIT and CABSINET programmes. The members of the consortia contributed to the creation and dissemination of new knowledge. The informal exchange of knowledge at seminars and access to working papers that were available only to members of the consortia were valuable to the new technology development.

The company also used scientific networks of R & D activities for monitoring the external technological developments and internalising potentially important technologies before the competition. For instance, the project team worked closely with the special interest groups for interactive audio to promote industry wide standards and to influence future standards for audio rendering guidelines. As a result, the company integrated the industry DirectSound3D standardisation into its applications ahead of competitors. In a press release, ResearchCo's customer-relations manager stated:

> "At ResearchCo we place great importance on our involvement with the Special Interest Group (SIG). The SIG has been highly influential in the development of audio standards, features and APIs… By integrating these developments at such an early stage we have provided [game] developers with a platform to incorporate the next level of realism into their games".

Similarly, the SIG recognises the benefits of collaborative relationships with industry partners. The chairman of the SIG commented:

> "We are very proud to announce ResearchCo's support for these enhancements. It is through this type of industry co-operation that progress can be made".

Interviews revealed that the over-riding goals for entering into collaborative partnerships were pooling of expertise, long-term exchange of know-how, skills and experience and the broadening of the product/service offered. However, the project members stated that successful outcomes were not always achieved. They identified the risks associated with collaboration as "insufficient prior knowledge and experience of the technology" [the chief scientist], "mismatched expectations of partners, hindering technology releases" [managing director], "concerns about proprietary technology" [marketing director] and "lack of communication and consultation between partners" [customer relations manager].

The interviewees identified the relative importance of benefits gained from collaborative relationships with external partners. The three most significant benefits identified were the variety of perspectives and new ideas for the innovative technology, access to technological advancements for broadening of the products offered and the reduced time taken to develop and commercialise the new products. Also ranked high were the generation of revenue from the company's intellectual property through licensing partnerships. A few project members viewed collaborative relationships as gaining the goodwill of customers by promoting industry wide standards and influencing future standards, as noted above. In contrast, factors such as reducing the costs of development were identified as least important.

According to the interviewees, factors that make collaborative partnerships successful were "complementary strengths" [the chief scientist], "realistic aims, mutual trust and openness" [managing director], "mutual benefits to all partners and commitment to the same goals" [marketing director], "flexibility" [operations director] and "frequent communication" [customer relations manager].

In addition to the business partners, the other valuable partners in the collaborative relationship were the customers. The study next examines the company's strategy for customer relationships to illustrate how value was created through partnership with the customers.

Collaborative Relationships with Customers

It was evident that ResearchCo created value through the rapid commercialisation of the core technology by entering into collaborative partnerships with many business customers. The project team's many partnerships with customers ranged from licensing partnerships with audio chip, soundcard and console manufacturers to development tools agreements with game developers and middleware providers. ResearchCo's engineers worked very closely with the teams at the customers, in order to optimise the 3D audio processing capabilities. Personal relationships with the customers enabled the flow of technical knowledge between the parties, which facilitated the development of many variants of the technology.

Initially, ResearchCo entered into licensing partnerships with audio chip manufacturers, as it needed financial resources to develop the technology further. In return for ResearchCo's superior technology, the licensing partner provided up-front fees, which were then used to develop many variants of the core technology for the gaming industry. In many cases licensing agreements evolved into joint ventures, as evidenced by the marketing director's statement:

"By renewing our licensing agreement XYZ inc. [the semiconductor manufacturer] demonstrated their commitment to the successful relationships we have established over the last few years. We are continually improving our algorithms ensuring that XYZ inc. can offer the most comprehensive technology available".

The strategic alliances between ResearchCo and its customers created commercial benefits for both parties that neither could achieve alone in developing leading audio solutions. The collaborations are expected to be the forerunners of further shared commercial developments in the area. For instance a licensing partnership with a leading developer of microprocessors combined ResearchCo's 3-D audio technology with the chip developer's audio controllers to deliver audio driver and application support for the customer's PC solutions. The two companies had complimentary assets and proprietary knowledge of their respective technologies. This compatibility was highlighted in a press release in which the customer commented:

"When we were looking for hi-end software support for the latest game audio standards, ResearchCo's audio technology was the natural choice as an acclaimed universal technology".

In the same way, ResearchCo entered into a third-part development tools agreement with a leading developer of interactive entertainment, which enabled ResearchCo's audio middleware technology to support the customer's products. The partnership enabled the implementation of extended audio functionality across all the major console platforms of the customer, which resulted in a reduced time to market for the customer's products. By maintaining a high level of support to the business customer and a strong problem-solving capability, ResearchCo's technology has continually evolved to set new standards in audio reality for interactive gaming.

Consistent with the above observations, the key project members identified the benefit of having a close partnership with the customer as the ability to translate the customer requirements into development needs. The three most significant benefits as identified by the key project team were, the ability to be more responsive to customer needs, the ability to accelerate the product development process and the ability to incorporate customer's new technology in the development process. Also ranked high were the reduced effect of the competitors' efforts, enhanced reputation of the company and the enhanced value of the company.

In summary, the examination of proposition 6 reveals that although ResearchCo developed the technology in-house, the innovation benefited from external collaborative partnerships. The

relationships with external parties provided new ideas for the development of the technology and enhanced the learning capacity of the project team. Thus the team acquired external knowledge to complement the internal R & D capability. It was evident that the key project members were aware of the risks associated with collaboration as well as factors that made collaboration successful, which contributed to the efficient and effective integration of external knowledge.

The complexity of the technology and the novelty of the multimedia market in which the technology was used meant that the project team worked continuously with the lead users to continually evolve the audio products (the algorithms) range. These lead users, because of the problems they had already experienced, provided the team with product design insights. The close working relationships with the business customer enabled the rapid adoption of ResearchCo's technology by the market place, giving them a competitive advantage.

Table 6.6 presents the summary of case evidence relating to the indicators of proposition 6, together with the respective sources of evidence.

Construct	Indicators	Case Evidence	Source of Evidence
Relationships with business partners	• Types of collaborations	Memberships in special interest groups Scientific consortia and similar networks	Observation, interviews, documents
	• Benefits gained	Variety of perspectives and new ideas for the technology Access to technological advancements Internalisation of know-how Generation and protection of intellectual property	
Relationships with customers	• Strategic partnerships with customers	The project team worked continuously with lead users Evolution of the technology to serve the changing market needs Development of the many variants of the technology	Documents, interview, observation

Table 6.6: Summary of Evidence Relating to Collaborative Intelligence in Proposition 6

The sub-sections 6.4.1 – 6.4.3 examined the six propositions relating to the three dimensions of intellectual capital in an innovative context. In doing so, the researcher examined the impact of

each construct of the theoretical framework on organisational value creation. The next section provides an overview of the outcomes of the empirical examination.

6.4.4 An Overview of the Outcomes of Examining the Propositions

Similar to case study one, findings from the study two provide empirical support for all the propositions of the research model at varying degrees. *Very strong* support was found for *propositions 1, 2 and 3* that relate to the human capital of ResearchCo. For instance, the scientific knowledge of the cross-functional personnel, the commercial capabilities of the key project members and the creativity and motivation of the team played a very important role in the new technology development capability. Further, there is evidence that skills, creativity and motivation of employees are interrelated. For example, at ResearchCo, the expertise of individuals influenced their tacit analytical skills and developed knowledge for evaluating alternative solutions. The creativity of individuals enabled them to apply knowledge in different situations, while their motivation provided the inner drive and the commitment to use the skills. In the same way, the *very strong support for proposition 6* indicates that the relationship capital played a vital role in the company's value creation process, where the company improved its innovative capacity by leveraging the complementary skills of the external partners, including customers. ResearchCo's external relationships increased the company's openness to the environment and provided access to the broad range of knowledge that was necessary to fully exploit the capability of the new technology. However, the *propositions 4 and 5* that related to organisational capital were only *moderately* supported. It was evident that only some elements of the organisational capital in terms of the enabling conditions and organisational processes were available to the project team. A strong element of the organisational capital was the vision and the ability of the key project members to judge the potential of the development paths and direct the scarce research funds towards the development of more valuable streams. This was critical in the determination of the company's strategic choices. Similarly, the company demonstrated a strong orientation towards innovation and displayed high innovative norms and values. In contrast, the company has not completely moved away from the rigid hierarchical and bureaucratic structures. Also, the members reported that they had to compete for some resources in terms of research funds and availability of time.

The strength of the case evidence was rated on a 5-point Likert type scale from very weak to very strong. The evidence has been rated subjectively, using the perception of the 5 key project members as a guide to assess the strength of each construct. Table 6.7 illustrates the 5-point Likert type scale.

Perceptions of key project members, used as a guide to assess the strength of each construct.	Very Weak	Weak	Moderate	Strong	Very Strong
For example, the number of interviewees who displayed agreement to constructs of the propositions	1	2	3	4	5

Table 6.7: The 5-Point Scale Used to Assess the Strength of the Evidence

Following from the discussions above, table 6.8 summarises the outcomes of the empirical investigation in terms of each proposition examined.

Proposition	Construct	Summary of empirical evidence	Deductive test outcome
P1 – Types of intelligence *There are two main types of intelligence that are associated with the innovation process. They are (a) technical knowledge that is relevant to the task or problem, and (b) social, political and interpersonal knowledge that is specific to the organisational context.* *Both types of knowledge are characterised by procedural knowledge (know-how) that enables the combination and recombination of declarative knowledge (know-what*	Technical knowledge (Domain relevant intelligence)	As per table 6.1	**Valid** **very strong**
	Social, political and interpersonal knowledge	As per table 6.1	**Valid** **very strong**
	Combination of procedural and declarative knowledge	As per table 6.1	**Valid** **very strong**
P2 – Level of intelligence *There are two main levels of intelligence that affect the innovation process. They are (a) individual intelligence that is d main specific and (b) organisational intelligence that is context specific.*	Individual intelligence	As per table 6.2	**Valid** **very strong**
	Organisational (collective) intelligence	As per table 6.2	**Valid** **very strong**
P3 – Creativity *Individual creativity is an antecedent of inn vation*	Creative outcomes of project members	As per table 6.3	**Valid** **very strong**
P3a – Cognitive skills *Individual creativity is influenced by two cognitive characteristics: (a) when there is task domain intelligence (declarative knowledge) and (b) when there is flexibility in combining rules (procedural knowledge)*	Domain knowledge	As per table 6.3	**Valid** **very strong**
	Flexibility in combining rules (procedural knowledge)	As per table 6.3	**Valid** **very strong**
P3b – Behavioural Characteristics *Individual creativity is influenced by two behavioural characteristics: when individuals have (a) a high intrinsic motivation and (b) personal orientation toward creativity.*	Intrinsic motivation	As per table 6.3	**Valid** **Very strong**
	Personal orientation toward creativity	As per table 6.3	**Valid** **Very strong**
P3c – Situational Characteristics *Individual creativity is influenced by two situational characteristics· (a) when the problem is novel, unfamiliar or heuristic and (b) when an intelligent approach to problem solving is expected and valued.*	Task novelty	As per table 6.3	**Valid** **Very strong**
	Organisational orientation	As per table 6.3	**Valid** **Very Strong**

P4 – Enabling Conditions Individual creativity results in innovation under four main enabling conditions: (a) when there is opportunity for creative expression (b) when there is an absence of constraints (c) when there are adequate resources and support to develop ideas and (d) when there are incentives that enhance intrinsic motivation.	Opportunities	As per table 6.4	Valid Very Strong
	Absence of constraints	As per table 6.4	Valid Moderate
	Resources	As per table 6.4	Valid Moderate
	Rewards and incentives	As per table 6.4	Valid Strong
P5 – Organisational and Situational Context Organisational innovation is influenced by two situational conditions: (a) high organisational orientation to innovation and (b) when situational factors favour the expression of innovation.	Organisational orientation to innovation	As per table 6.5	Valid Very strong
	Organisational structures	As per table 6.5	Valid Moderate
P6 – Collaborative Business Intelligence Innovation is influenced by collaborative business intelligence in the form of: (a) collaborative relationships with business partners and (b) collaborative relationships with customers.	Relationships with business partners	As per table 6.6	Valid Very strong
	Relationships with customers	As per table 6.6	Valid Very strong

Table 6.8: Outcomes of the Empirical Investigation at ResearchCo

This section and its sub-sections have discussed the propositions and their indicators on an individual basis and have examined the value creating potential of the company's intellectual capital factors. The indicators represent the 'what' that is required to achieve value creation while the interrelationships between the IC dimensions represent 'how' value is created. Based on the examples and discussions presented so far, the next section explores the mechanisms by which IC factors contributed to value creation within ResearchCo.

6.5 Interrelationships among IC Factors to Facilitate Value Creation

Similar to the first case study (ConsultCo), it was evident that the development of the new technology was not identifiable with one dimension of intellectual capital, but was a combination of various elements. The researcher's observations show that the key project members combined intellectual capital factors creatively to produce unique firm-specific capabilities. As discussed in chapter 2, capabilities are intermediate goods that enable a company to deliver a fundamental customer benefit such as, in the case of ResearchCo, the 3D audio and other sound technologies. For example, the project team's technological capability

such as the ability to develop digital synthesis of spatial hearing cues comprised of a bundle of skills (e.g. know-how in physics of human hearing process) and resources (e.g. feedback from customers), and reflected the company's capacity to integrate skills and resources to transform them into end products.

Evidence suggests that this integration was the distinguishing feature of the company's superior performance. The integration mechanisms guided the organisational capabilities that were developed slowly over a period of time and therefore were specific to the company. This idiosyncratic nature of the capabilities makes them difficult to replicate by competitors, providing an enduring source of competitive advantage.

As with the first case study, it was possible to identify the integration mechanisms employed by ResearchCo into the same three broad categories, based on their strategic roles. For example, at ResearchCo, some mechanisms combined the existing skills and resources, while others acquired new knowledge from outside and built on them. The third category of mechanisms accumulated firm-specific knowledge through activities such as knowledge sharing and organisational learning. It was evident that the company used a mixture of these mechanisms, not just a single form, to develop capabilities. Each category of integration mechanisms as evidenced at ResearchCo will be discussed next.

6.5.1 Combine Existing Skills and Resources

The discussions in the previous sections indicate that the capabilities needed for the new technology were developed through *combining and reconfiguring* the existing organisational skills, resources and functional competencies. For instance, the development of the 3D audio technology involved *combining* the varied skills and tacit understanding of the scientists and engineers from specialised disciplines and with other non-technical functions such as marketing and quality assurance. The exchange of knowledge and information was facilitated through regular meetings, discussions and seminars and through other means such as 'loaning' specialists from other functions for specific project assignments. The company's information and communications technology (ICT) infrastructure in terms of the electronic networking and the Intranet enabled the speed and flexibility of knowledge integration. However, as discussed under sub-section 6.2.3, it was the strong interpersonal element rather than IT that accomplished the effective sharing and communication of valuable knowledge. It was evident that by interacting with each other, the team generated strong feedback and continuous learning. The process also improved joint contributions to the understanding of complex problems and developed collective knowledge in the face of rapid market and technological change. The researcher's observations also show that the key project team pooled their various commercial,

business and technical expertise to make the choices that shaped the innovation. In addition, the key project members recognised the need to align with the overall vision and the importance of carefully co-ordinating the people and their activities to ensure the effective use of existing resources. The processes in this respect included taking deliberate steps towards the stated objectives, re-planning, dealing with unexpected events and encouraging multiple perspectives and debate. These processes were central to translating the technological development into a commercial product and improved the management's ability to move quickly into fast changing markets. The 3D audio project is also an example of ResearchCo's ability to build on early successes and *reconfigure* and refine its existing knowledge. For instance, the company's invention of stereo in the 1930's influenced and shaped the development of the 3D audio technology. The company used its accumulated knowledge as a springboard to explore the technological paths that it enabled to exploit.

All the above examples illustrate that the integration mechanisms that combine existing skills and resources develop slowly over time and therefore are firm specific in nature. The above examples also suggest that the skills and the expertise of the company's employees are a prerequisite for developing capabilities through combining existing knowledge.

6.5.2 Acquire and Internalise New Knowledge from Outside

The integration of resources was not limited to internal activity but also resulted from assimilating and internalising knowledge generated outside the company. ResearchCo could not rely solely on internal knowledge development since this would limit the scope of its activities. Due to the complexity of scientific input and the uncertainty of technological paths, the project team had recognised that they needed to absorb relevant knowledge from external sources for accessing new technological and market competencies. For this reason the team formed a web of links with the external scientific community (research consortia, university research departments), the suppliers of ancillary technology (manufacturers of the artificial head), the lead customers (chip manufacturers and interactive game developers) and various special interest groups (interactive audio special interest groups) that provided complementary knowledge. The mutual interaction with these external parties brought technological know-how into the company and enabled the new product to reflect customer needs.

At ResearchCo, in addition to accessing the technological and market know-how, the flow and the exchange of knowledge also involved a learning process that facilitated the absorption and internalisation of new knowledge. Absorption of knowledge gained from external sources and their integration with internal resources were central to the evolution and commercialisation of the technology and required repeated dealings, personalised relationships and trust between the

individuals in each organisation. The shared values and beliefs of ResearchCo's employees played an important role in the integration of external knowledge, where new ideas and different perspectives were valued. The company encouraged its employees to be open to potential technological developments and internalise them. However, it was evident that the team accessed new external knowledge selectively. For instance, the new knowledge was in some way related to the team's existing knowledge, where the existing competencies provided a basis for incorporating the external knowledge. For example, the team's recent collaborative activities with scientific consortia addressed areas that could be combined with the present technology in order to develop a range of new applications of the 3D audio technology such as in DVD and mobile phones.

6.5.3 Accumulate Firm-specific Skills and Resources

Capabilities were also developed through the knowledge that the company accumulated over time. It was evident that ResearchCo accumulated knowledge through three main practices. First, the continuous experimentation and the iterative execution of scientific processes involved *learning by doing*, thus contributing to the individual experiences. For instance, the learning that occurred during the 10-year life of the project added to the tacit knowledge of the project team in the form of depth and breadth of understanding of the technology and was held by both individuals and the team as a whole. Because all of this tacit knowledge was difficult to codify, it only manifested through the actions of the project members, for example, as improved performance. Secondly, the *explicit element of the team's knowledge was codified* in documents and databases and diffused within the company through the company's rules, procedures and operating guidelines. As discussed previously under proposition 1, it was the responsibility of the operations director to maintain formal procedures in order to ensure decisions and progress were documented, so that the implications of actions could be easily understood. The team also made use of the explicit knowledge already available within the company such as supplier and customer information, operating guidelines and project schedules. Thirdly, the integration of existing knowledge and acquisition of new knowledge as discussed above, *created collective knowledge* within the company, resulting in collective remembering and learning capabilities, which both added to previous knowledge and changed the company's ability to use its knowledge. For instance, the cross functional and cross disciplinary involvement in the development of the 3D audio technology added to the company's broad spectrum of specialised knowledge and helped to further disintegrate any boundaries created by the departmental structure. In addition, it was evident that some strands of the technology was incorporated into technologies in other functions such as 'Communications', that gave rise to new innovations. In the same way patterns, routines and shared beliefs gradually developed around how the 3D audio project was developed and managed in terms of planning, focused problem solving, co-

ordinating of activities, repeated experiments and so on. Over time, these patterns, routines and shared beliefs became embedded in the organisational structure to evolve firm-specific capabilities.

In summary, ResearchCo built its strategic capabilities such as R & D capability, continuous innovations, responsiveness to market trends and management talent that co-ordinated and re-deployed internal and external resources by combining human, organisational and relationship capital factors. The integration mechanisms that were in operation at ResearchCo could be categorised into the same three mechanisms as in case study one. The integration mechanisms facilitated the exploitation of existing knowledge and the development of new knowledge. ResearchCo's strategic capabilities are embedded in its different kinds of managerial and organisational processes as evidenced in the above examples.

Thus, it is difficult to explain value creation only in terms of the company's individual intellectual capital resources. The above discussions show that the careful co-ordination between intellectual capital factors was important. Given that ResearchCo possessed many types of skills and resources, the challenge for the key project members was to co-ordinate and integrate these to develop capabilities that contributed to value creation.

Strategic Role	Integration Mechanisms Used by the Company
Combine existing resources and skills	• Use of cross-functional teams to pool expertise – a strong interpersonal element present • Co-ordination of people and activities • Reconfiguration of resources to create new technology
Acquire and internalise new knowledge from outside	• Links with the scientific community, suppliers and lead users • Build new thinking in the light of new experiences • Selective use of new knowledge
Accumulate firm-specific skills and resources	• Learning by doing • Encoded knowledge in organisational routines and processes • Develop collective knowledge

Table 6.9: Summary of Evidence Relating to Integration Mechanisms

6.6 Assessment of Value Creation

Having examined the propositions in respect of the individual intellectual capital factors and the mechanisms with which value was created at ConsultCo, this section examines the evidence for value creation.

The value creating potential of the intellectual capital factors and the strategic capabilities they created were critical for the success of the 3D audio technology. Since the essence of value is the prospect of benefits (as described in chapter 2), this section examines the benefits derived from the project to the customer and to the company.

Benefits to the Customer

The benefits to the customer were assessed using the company documents and press releases. In addition, interviewees were asked to comment on how the customer benefited from the technology. All of the interviewees stated that the concept of the technology was new thereby providing a benefit unavailable previously to the customer. They also said that the benefit is substantial in that the benefit offered goes beyond "nice to have". Since the project team is continuously upgrading the technology and developing new variants, the interviewees opined that customers would continue to benefit from the products for the foreseeable future.

As discussed previously, the 3D audio technology evolved through the company's close collaborations with the lead users such as interactive game developers and chip manufacturers. The benefits to the customers of ResearchCo's close partnerships with them were described in a press release as:

> "ResearchCo's engineers work very closely with game developers across the globe to ensure that the 3D audio technologies are ideal for their needs".

A semiconductor company who recently renewed a licensing agreement with ResearchCo to further strengthen their strategic partnership described the benefits of the relationship as:

> "We have always taken great pride in providing the best quality product.... Our continued relationship with ResearchCo, supports this and their continually evolving audio expertise ensures that our technology is the best available".

In collaboration with the lead users, the team has developed many variants of the technology in order to expand the capabilities and the applications of the 3D positional audio. ResearchCo's marketing director commented in a press release:

"By maintaining a high level of personal contact, we are continually improving and expanding our algorithms ensuring that our customers can offer the most comprehensive technology available".

ResearchCo created substantial further benefits to the customers and end users by integrating the guidelines presented by the 'Interactive Audio Special Interest Group'. By supporting industry standards and enhancements, the technology offers compatibility with older games and provides game developers with "a platform to incorporate the next level of realism into their games" [ResearchCo's customer relations manager].

Benefits to the Company

The value created by the project was assessed in terms of the benefits gained by the company through competitive advantage, sustainability of the company's advantage, the technology's potential for the future and any non-financial benefits accrued to the company. The benefits were assessed based on interviewee perceptions and documentary evidence. The interviewees were asked to comment on the degree to which the project created competitive advantage to ResearchCo. All of the five interviewees said that the project was a success and that the technology contributed to competitive advantage through the substantial benefits offered to the customer in terms of novel applications, continuous modifications and compatibility with industry guidelines, as discussed above. The company's competitive advantage and industry leadership is further evidenced in the press announcements that the technology is now available on over 55 million PCs worldwide and is licensed to the world's leading audio chip manufacturers, who together supply in excess of 60% of the audio chip market. According to the press announcements, the technology has become the de facto standard for 3D audio software in PCs.

In the researcher's attempt to assess the sustainability of value and advantage, the interviewees were asked to rate several project outcomes. All of the interviewees agreed that the customers would continue to benefit from the technology for the foreseeable future. However, they said that the benefit to the company of the continuous modifications and expansions to the algorithms is contingent upon the actions of competitors. The biggest challenges in this respect were identified as the rapid changes in multimedia technology and markets and the dynamic competition faced by the project team. All of the interviewees stated that their core technology provides opportunities for continuous innovation. The many white papers being published by the project team discuss the current work in progress where the existing technologies are combined and extended to create a crossbred series of totally new products. These are expected to offer major technological opportunities in the future. As noted previously, in addition to the

core technology of placing sounds in three-dimensional space around the listener, the project team has developed a suit of complementary technologies for use in mobile phones and hand-held computers and the Internet. This capability to consistently innovate provides the company with sustainable competitive advantage.

The future potential of the technology was also evident in the long term partnerships and the long term revenue streams that the company has secured through licensing agreements with several leading game developers, semiconductor companies and PC manufacturers.

In addition to the commercial benefits, the interviewees recognised several other types of benefits. All project members stated that the project facilitated new insights and learning for future efforts. In the same way, the interviewees recognised that the project team's many years of experience in designing and developing the 3D audio technology generated accumulated and mainly tacit knowledge. As illustrated throughout this case study, this skills/knowledge dimension has become a source of innovation and value creation for ResearchCo.

In summary, ResearchCo creates value by delivering substantial value to the customer through their unique technology that provides extended audio functionality and high quality audio across a wide range of platforms. The company has created long term advantage through continuous innovation and through many licensing partnerships with leading audio vendors, making the company an industry leader in advanced PC audio technologies. The company's ability to innovate continuously has become the source of competitiveness and value creation for ResearchCo.

Table 6.10 presents the factors that were visible within the company generally, and more specifically, within the project team, as relating to value creation. These indicators of value creation are both financial and non-financial.

Indicators of Value Creation	Case Evidence	Source of Evidence
Benefits to the customer	• Many variants of the technology to provide new and useful solutions to problems	Documents, interviews
	• Close working relationships	Documents
Competitive advantage	• Brand recognition	Documents
	• Global reputation	Documents
	• Industry leadership	Documents
Sustainability (length of time a competitor would need to acquire the company's competence)	• New strands of technology	Interviews
	• New applications of the technology	Interviews
	• Continuous innovation	Interviews
Potential for the future	• Customer relationships through long-term partnership	Interviews
	• Long term revenue streams through licensing and royalty income	Documents
Non-financial benefits	• New insights	Interviews
	• Accumulated knowledge	Interviews

Table 6.10: Summary of Case Evidence for Evaluating Value Creation

6.7 Conclusions from Case Study Two

In conclusion, this chapter has analysed empirically, the value creating potential of ResearchCo's intellectual capital and has explored the interrelationships among the IC factors that effect innovation. As in study one, the mechanisms with which the company transforms its intellectual capital factors into profitable technologies were analysed into the same three broad categories, based on the strategic roles of the mechanisms.

In contrast to study one, ResearchCo's product innovations are technology based. The company views itself as an innovative organisation with a strong R & D capability as indicated in their annual reports and press releases. It was evident that the company's organisational practices are geared towards exploiting new technological and market opportunities. The company has identified several technological paths based on its accumulated competencies and its track record of past successes. One such path was 3D audio. The development benefited from the in-house competence in stereophony and was transformed into radical new technologies with wide ranging applications in PCs and consumer electronics.

Similar to study one, this case study has demonstrated that an organisation's ability to create value is rooted primarily in the skills and tacit knowledge of its employees, who define

problems, share insights, create customer relationships and accumulate knowledge as a collective. Although the expertise of individuals was regarded as the basis of idiosyncratic capital within the organisation, there was evidence that the project benefited from the collective wisdom and the creativity of the entire team. Moreover, it was evident that by interacting with each other, the team created knowledge that transcended the knowledge of each of them individually. For instance, organisational learning and continuous improvement was achieved through the interaction of functionally specialised individuals within the project team.

A key characteristic of the company's innovative capabilities was that they were a result of a cumulative resource development process, which led to a build-up of firm-specific skills. As noted previously, an important task of the key project members was the integration of individuals' specialist knowledge through co-ordination and communication. Most specifically, they worked to develop processes through which tacit knowledge was transferred and integrated. The study shows that value creation is not about unique skills and competencies per se, but about how to combine them in ways that are difficult to imitate by competitors. As all the necessary components of the accumulated firm-specific competencies are difficult to identify, successful strategic capabilities are difficult to reproduce by competitors.

As the project evolved, the key project members identified specific technologies and practices to build upon and support the focal technology. Thus a critical point to emerge from the study was the importance of the organisation's ability to identify the type of knowledge required by the changing competitive environment. The above example also illustrates the perishable nature of knowledge, which required the company to renew knowledge continuously. This ability to innovate continuously has become the source of competitiveness for ResearchCo.

This chapter and the previous chapter provided a within-case analysis of two case studies. The next chapter is concerned with the comparative analysis of the two cases, based on which a descriptive framework is formulated with respect to value creation from intellectual capital, which is the aim of the next chapter.

Cross-Case Comparison and the Development of a Framework for Value Creation

7.1 Introduction

The previous two chapters (5 and 6) presented contextually rich data specific to two projects and examined the link between intellectual capital factors and value creation in two innovative contexts. In interpreting the data, the research illustrated each construct of the theoretical model as developed in chapter 3, with a variety of examples within the two companies. This chapter conducts a cross-case analysis of the two case studies in order to compare and contrast the value creating potential of the intellectual capital factors and to develop a descriptive framework of value creation that is informed by this research.

The next section and its sub-sections present the key characteristics of the findings derived from the two cases on a comparative basis. This analysis provides a discussion of the different dimensions of intellectual capital and their associated value implications leading to the development of a descriptive framework, which is presented in section 7.3. Section 7.4 explores the applicability of the framework. Several implications for practice are outlined in section 7.5. Section 7.6 concludes the chapter.

7.2 Cross-case Comparison

The theoretical framework as described in chapter 3 has been examined in two different innovative contexts. The first case study described the innovative development of a hospital concourse by ConsultCo, a management consultancy company (chapter 5). The second case study described a radical technology invention by ResearchCo, a research and development arm of an intellectual property company (chapter 6). Both cases involved a complex product, which brought together many disciplines, required collaborative external partnerships and involved long time scales and high levels of risk. The output measures of value creation for both projects were innovation, continuous improvement, benefits to customers and the company and

competitive advantage. The following represents the findings derived from the subjective interpretations of data from the two case studies. The discussion will be organised with reference to the propositions of the theoretical framework within the three dimensions of intellectual capital, which have provided the organising structure to this work throughout. As a first step to the cross-case analysis, a few general observations resulting from this research are noted below.

7.2.1 General Observations

Both ConsultCo and ResearchCo are knowledge-focused organisations that operate in dynamic markets in which the rate of product and service innovation has increased dramatically in recent years. This has meant that the source of competitiveness for both companies was their ability to develop new knowledge continuously. Therefore the primary role of intellectual capital for both companies was to create innovations (putting new ideas into practical use) that would become their products and services. ResearchCo focused its science-based innovative activities around formal R & D including filing and exploiting of patents. ConsultCo placed a heavy emphasis on service development often with variants of the basic service concepts.

Evidence shows that elements of all the IC factors proposed as driving innovation were found to influence the success of the two projects. The relevance of all the IC factors to success was expected given that each emerged from an intensive analysis of the literature. However, the examples show that IC is context specific in that the nature of IC factors and the way they were put together for successful innovation varied between the two companies. For instance the collective experiences of employees in ConsultCo would not have any value or relevance to ResearchCo, since they were internally created as solutions to specific conditions. In the same way the performance of employees was influenced by different situational and motivational factors within the two companies. This observation is in line with the work of Harrison and Sullivan (2000) who find that the roles played by intellectual capital factors depend on the kind of firm it is, its vision for itself and the strategy it employs to achieve that vision.

This research would like to single out the most critical element that was evident in both cases and across all three dimensions of intellectual capital as *the quality of intellectual capital factors* that impacted on value creation. The review of the two case studies showed that the quality of knowledge resources available to the companies had a strong impact on their strategic advantage. For instance, in both companies, the high leadership commitment and support was a significant and distinctive resource that contributed to value creation. This finding provides empirical support for Collis and Montgomery's (1995) theoretical perspective that competitive advantage, regardless of its source, ultimately attributes to a valuable resource that enables the

company to perform better than competitors. Conversely, the poor ICT support available for ConsultCo's project team hampered communication among the wider circle of the collaborative project members, and thus restrained innovation. This negative effect has been identified by Grant (1991) when he argued that the quality (as well as the type and amount) of resources can place constraints upon the range of organisational activities that can be performed and the standard to which they are performed. However, the quality of intellectual capital factors can be influenced through organisational and management processes, as discussed under sub-section 7.2.3 – organisational capital.

The other critical point that emerged from this research was the observation that resources, on their own, are not productive. Value creation was intimately tied to each company's routines and practices that existed around how the two projects were managed and that determined how the individual IC factors were integrated to develop capabilities. In both companies, these sequences of actions were learned over periods of time through trial and error and involved formal procedures as well as informal conventions, and thus were specific to each company. Evidence suggests that the key project members who were also the senior managers of the respective companies influenced an integrated set of routines and practices in order to achieve the desired outcome. These routines included, inter-alia, how the project members co-ordinated the efforts across different functions, how they accessed external resources and how they evaluated, reflected upon and learned from the process. It was evident that, over time, these routines became embedded in the organisational systems in the form of commonly understood roles and became the experience-based part of the company's knowledge base.

The innovative context that was common in both companies is depicted in figure 7.1. The figure illustrates the finding that each dimension and its associated components are deeply interconnected and as such form an integrated whole. The findings also suggested that the active integration of these components was what created value. The *value implications* of each component of the three IC dimensions as found in the two case studies will be discussed next on a comparative basis.
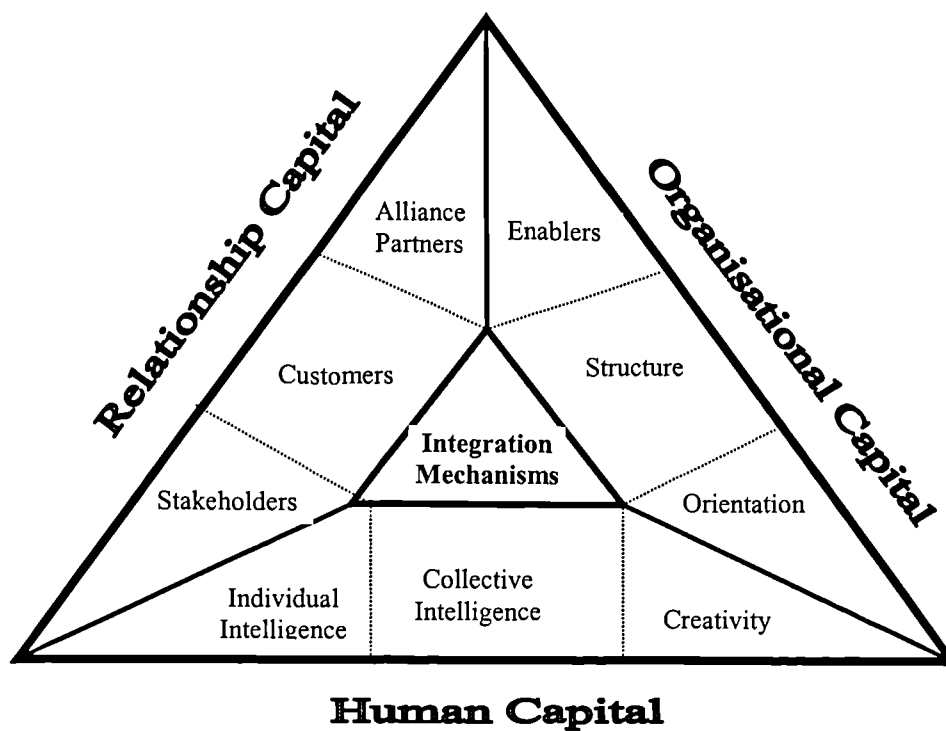
Human Capital

Figure 7.1: The Innovative Context Common to both Case Studies

7.2.2 Human Capital

This research examined the human capital factors both at the individual level (proposition 1) and at the collective, organisational level (proposition 2). The researcher's observation is that the attributes relating to human capital are distinguished more by similarities than by differences across the two companies. For instance, both projects are characterised by their dependence on highly skilled knowledge workers and their problem solving ability for innovative performance. *Consequently, the two companies* sought customers and markets according to their current technological base and the distinctive competencies of their employees, thereby building the business on the strength of their domain specific expertise. What the companies currently know provided a basis for selecting market opportunities and building upon established competencies in a way that improved overall business performance. This observation is supportive of Dierickx and Cool's (1989) conjecture that adding to the existing base of resources that a firm possesses enhances the competitive advantage and influences the pace at which assets can be accumulated. The influence on the pace of innovation was evident at ResearchCo when significant delay and time loss occurred due to insufficient domain knowledge available to the development team as a result of staff turnover. In both companies, domain specific knowledge provided a basic learning capacity that was needed to absorb new knowledge from external sources (Cohen and Levinthal, 1990). Conversely, prior studies have shown that innovation failure occurs when

firms attempt to launch products that do not match their competence base (e.g. Cooper and Kleinschmidt, 1990; Cooper, 2000). Amabile (1996) considered domain relevant skills (factual knowledge, technical skills and special talents in the domain) as the basis for any performance in a given domain. Amabile (1996) contends that there is a high correlation between creativity and proficiency in the routine domain relevant tasks. Similarly, Cooper (1999) identifies the availability of individuals with deep knowledge and expertise as one of the invisible success factors in product innovation. However, there also appears to be a compelling competing view. Leonard Barton (1995) found in her studies that the deep knowledge that leads to core competencies can also become core rigidities in the companies, thereby necessitating the continual upgrading and development of knowledge in order to be able to respond to changing market and environmental conditions.

In addition to the domain specific technical skills, both project teams comprised of members who displayed context specific, social and political skills. It was evident that the presence of the two types of personnel facilitated both the creation and implementation of innovative ideas. However, as well as the two types of personnel described by Leonard-Barton (1995) and Glynn (1996), the analysis of this research indicates that some individuals displayed a range of knowledge consisting of highly specific domain relevant skills to interpersonal skills. For example, at ResearchCo, there was evidence that the two types of personnel complemented each other's strengths, where the scientists and engineers carried out the technical activities while the operations, sales and customer-relations managers influenced the acceptance and commercialisation of the technology. However, at ConsultCo, the distinction was not so clear cut, where in each job, coping with the socially and politically sensitive external relationships was as important as the demonstration of technical proficiency. This observation is consistent with Alvesson's (2000) findings that the management of interaction processes is central to knowledge-intensive professional work. Similarly, Grey (1998) identifies in a study of a "big-six" accounting firm, that professionals display a technical-behavioural spectrum and that technical expertise was only the basic pre-condition for being considered to be a professional.

The examination of proposition 2 found that both companies accomplished innovation through highly skilled individuals working in diverse, cross-disciplinary groups. Bringing individuals together from different functions to work on a project or problem was a normal practice in both companies. The cross-functional nature of the teams ensured the availability of complementary skills, providing a broader knowledge base. Thus the teams were able to combine related technologies in a more complex manner, resulting in advanced products and services. This implies that the breadth as well as the depth of knowledge contributed to the success of the projects. Consistent with this observation, Cooper and Kleinschmidt (1993) in their study of

companies in the chemical industry found that the involvement of cross-functional teams within a project dramatically improved both time-to-market and success rates. The diversity also influenced the variety and quality of solutions generated and the nature of discussions about alternative solutions. This observation is consistent with Bantel and Jackson's (1989) study that concluded that both the level and the diversity of expertise are beneficial for complex problem solving. The observation is also in line with Tenkasi and Boland's (1998) view that knowledge intensive companies require the integration of multiple and differentiated forms of expertise in ways that will yield new insights into a problem. Evidence shows that both ResearchCo and ConsultCo orchestrated the transformation of basic intellectual material generated by its individuals into innovation through social and institutional arrangements such as network relationships, shared sense of purpose, cross-functional teams and supportive work environments. Thus, despite the individualist nature of the scientists' and professionals' work, the project teams developed a shared understanding that led to a complex process of collective knowledge creation within the respective teams. Brown and Duguid (1998) suggest that this collective organisational knowledge provides a synergistic advantage that is not replicable by competitors, thus providing a basis for value creation. In a similar vein, Senge (1990) argues that the ability of organisations to create systemic knowledge by integrating their various interdependent parts is central to organisational learning.

The strong empirical support for proposition 3 and its sub-propositions 3a, 3b and 3c suggests that in both companies, creativity of individuals led to innovative performance, yielding significant competitive advantage. The project teams displayed creativity in two main ways. The *conceptual insight* of project members generated novel and useful solutions to customer needs. For instance, ResearchCo's successful development of 3D audio technology owed much to the research leadership of its chief scientist who pioneered the technology. In the same way, ConsultCo's chairman pioneered the niche market of retail malls within hospital precincts in the changing health sector. However, creativity was not restricted to the initial idea generation stage or certain areas of the businesses. The members also *continually explored new perspectives* to overcome potential problems and developed new ideas out of the opposing circumstances or arguments. All of the interviewees had generated ideas or processes of value and originality that signified creative problem-solving outcomes in their respective work areas. The success of the two innovative projects was based on developing and implementing these creative outcomes.

It was evident in both companies that creative outcomes were linked to the individuals' expertise and experience in a specific domain. For instance, at ResearchCo, the scientists were creative in replicating the spatial hearing system while the marketing and customer-relations

managers identified novel applications for the technology based on the broader market and user perspectives. Consistent with Simonton's (1995) studies that found that substantial creative achievements come about on average after at least ten years of experience in a field, the key members of both teams had spent considerable amount of time in their specific fields. For example, the key project members of ResearchCo and ConsultCo have spent on average 13 years and 12 years in their fields respectively (see Appendices B and C for an analysis). One striking difference between the two companies was that in contrast to ResearchCo, ConsultCo's team was characterised by their domain specific skills *that influenced perfection and the ability to repeat successful patterns*, rather than creativity. Only some elements of their work allowed any real flexibility and creativity in carrying them out, such as for instance, identifying and pursuing the best strategic options for the customer. The reason for this anomaly was that professional activities such as those in finance or law are based more on delivering consistent, high quality intellectual output within established rules and less on creative, rule-breaking outcomes in their problem solving efforts as noted by Sveiby, (1995) and Quinn, (1996). However, it was evident that creative problem solving and routine intellectual output co-existed side by side in both companies. Amabile (1996) identified both domain relevant skills (factual knowledge, technical skills and special talents in the domain) and creativity relevant skills (application of heuristics, cognitive style and working style) as essential for creativity.

Both project teams displayed intrinsic as well as extrinsic motivation. However, it was clear that both teams were driven primarily by intrinsic motivation. For instance, both teams considered their projects challenging and intellectually stimulating. They all displayed a deep interest and personal satisfaction in the work, as well as a feeling of accomplishment. In particular, the long tenure of key members at ResearchCo signified high involvement and absorption in the project, which had an impact on creativity. In addition, the extrinsic motivation of members was evident in that all members worked to achieve the goals and milestones set along with the accompanying bonuses and other incentives. In contrast to previous findings (i.e. Amabile, 1988), which support the notion that the use of extrinsic rewards can suppress creativity, this research found that extrinsic motivation combined positively with intrinsic motivation to enhance creativity. Consistent with Amabile (1997), this may be because members' interest in the work was already strong and salient. In both companies, motivation towards innovation was also increased by the low occurrence of elements such as politics, destructive criticism, strict control by senior management and excessive formal structures and procedures. It was also evident that the creative activities of the two projects were influenced by the personal orientation of the members. For instance, all interviewees rated highly the need for originality, willingness to take risks and the readiness to entertain new ideas. They also indicated independence of judgement.

The support for the sub-proposition 3c in both companies suggests that several features of the project had a strong positive influence on the members' motivation and thinking skills that impacted on creativity. For instance the complex and non-standardised nature of the projects provided the members with a challenge and room to develop their creative potential. At Research Co, the scientists and engineers were allowed a great deal of freedom to pursue their ideas where they could enhance their interests and experiment with novel approaches. Similarly at ConsultCo the project members were constantly challenged to find novel solutions to their customers' needs. The presence of stimulating co-workers for both teams enabled the integration and explication of divergent tacit knowledge and introduced some competitive demands to contribute to the process, which enhanced creative performance. Both project teams enjoyed the commitment of their top management team to innovation, which encouraged self-initiative and expected creative outcomes. This observation is in line with Amabile et al's (1996) studies in which they found that the presence of innovation norms, the support of stimulating co-workers and the freedom of expression play a part in the emergence of creative behaviour of individuals. Amabile (1997) contends that the strongest and the most direct influence of the project environment is on the motivation of individuals.

Since employee competence and know-how were pivotal factors, both companies had in place a series of activities to assure the satisfaction, commitment and motivation of its members. It was evident that the many project members assumed a strategic partnership role, in which they pursued a set of agreed upon goals, had the responsibility for the outcome of the assigned tasks and shared benefits in the form of project related rewards. The high levels of emotional commitment to the respective projects in turn resulted in high levels of employee retention. Consistent with this observation, a recent study of 25 companies in the financial services industry concluded that business performance is positively influenced by the commitment of organisational members, which in turn acts as a deterrent to employee turnover (Bontis and Fitz-enz, 2002).

The two case studies have demonstrated that the human capital attributes of knowledge, skills, experiences, creativity and attitudes of employees and managers contributed to the success of the projects. The individuals defined problems, shared insights, and worked with customers in order to innovate. This implies that human capital *initiated* the value creating potential of the organisation. Moreover, it was evident that isolated stocks of knowledge that resided in the heads of individuals did not, single-handedly, contribute to the success of the two projects. It was clear that individual knowledge was nurtured, shared and supported through the organisational mechanisms, as discussed in the next sub-section.

7.2.3 Organisational Capital

The findings of this research suggest that the organisational capital in terms of enabling conditions (institutional systems) and contextual factors served to transform individuals' knowledge and creativity into competencies and innovation. Interviews revealed that the successful outcomes of the two projects were influenced by several organisational factors as discussed below.

Both teams found a high presence of several aspects of the work environment that stimulated their creativity and played a prominent role in the unfolding of the innovation process. For instance, the autonomy and the requisite power to act on one's understanding that was enjoyed by both teams allowed individuals to pursue their unique insights. The creative ideas were encouraged and implemented within the two organisations through shared team experience, constructive feedback and leadership commitment and support. Similarly, both teams reported that their contributions were recognised and acknowledged in ways such as company-wide announcements that confirmed their competence and that motivated creative output. Rewards were also in the form of project related financial incentives such as the bursary scheme for patents, monetary awards for journal publications (ResearchCo), and profit sharing schemes (ConsultCo) that also appeared to enhance performance in both teams. However, Amabile (1997) notes that financial rewards per se do not necessarily make employees passionate about their work, unless the initial levels of the intrinsic motivation are high. This implies that individuals will perform best when they feel motivated primarily by the interest and challenge of the work, and not by external pressure.

Within both project teams, the sense of involvement, the empowerment and the challenge experienced by the members made them feel that they co-produced the value of the business. The members anticipated that their contributions would prove worthwhile to the success of the respective projects. The expectation that they will be able to realise some of the new value created for the organisation made the team members assume the role of strategic partners rather than mere stakeholders within the organisation, which enhanced their intrinsic and extrinsic motivation and reduced turnover rates among the project members.

According to the project members, both organisations were characterised by an overall absence of constraints. For instance, working under pressure at times with excessive workloads and frequent interruptions was accepted as a way of life and viewed by both teams as creating a sense of urgency from the collective desire to accomplish tasks. This observation seem to contradict the earlier findings of Amabile and Gryskiewicz's (1987) study in which they

identified time pressure and excessive workloads as obstacles to innovation. However, Amabile (1996) contends that some degree of pressure is conducive to creativity and innovation.

The essential difference between the two companies lay in the resource allocations of each. ConsultCo had limited availability of resources such as funds, ICT infrastructure, short time frames and quick access to information. As a result, the project team experienced significant delay or time loss that affected their productivity. In contrast, ResearchCo's team had access to advanced information and communication systems as well as sufficient time for experimentation and exploration. However, both project teams attached a relatively low importance to the availability of physical resources. In particular, ConsultCo's case demonstrates that while resources and technological competencies are important for effectiveness, the ability to be creative and innovative is perhaps more important to value creation. ConsultCo's success despite the lack of resources is explained by Amabile (1996) who found that some aspects of the work environment such as sufficient resources and work pressure carried the least weight in influencing creativity and innovation.

In addition to enabling conditions, innovation was influenced by the organisational context in both companies. For instance, both companies displayed a high organisational orientation to innovation. At ConsultCo this aspect was evident in the rapid response to customers' changing needs and its organisation-wide problem solving through the use of multi-disciplinary teams. Similarly ResearchCo's strong R & D capability and its openness to ideas by diverse perspectives facilitated ResearchCo's continuous innovation. Both companies showed a very high recognition of the contribution of its members.

Several features of the organisational structure such as the empowering culture, management commitment to innovation, learning opportunities, flexibility and a formal innovation approach were emphasised in both sets of the interviews as impacting on performance. In particular, the consultative style of management by both project leaders encouraged participation in defining the problems to be pursued and approaches to be used, which increased individuals' involvement in the tasks and promoted self-initiative. The specific areas of strategic focus was clearly defined and communicated to the entire project team.

Both companies actively facilitated the flow of knowledge between all members of the project team. Information (of value and substance) was conveyed through formal but interpersonal means such as workshops and seminars, rather than through data repositories. However, the transmission of knowledge and experience did not always entail formalisation, as social networks and communities of practice were widely used in both companies. Amabile (1996)

notes that norms that promote open information exchange should encourage creative performance.

The above findings accord with the literature that increasingly reveals a relationship between organisational context and innovation. For instance, the positive impact of the organisational systems on innovation within the two companies is consistent with the studies of Amabile (1996) that found that factors such as freedom, leadership-support, co-operation across functions as well as sufficient resources promoted creativity. Locke and Kirkpatrick (1995) found that the leader's vision is a key factor when managing creative individuals. Similarly Nahapiet and Ghoshal (1998) identifies that a productive opportunity of a firm increases when those involved feel that their engagement in the knowledge creation will be worthwhile.

Thus, the results suggest that the organisational conditions under which a person works can significantly affect the level of creativity and the successful implementation of creative ideas by an organisation. Implicit in the above observations is the overarching conclusion that organisational capital supports (or constrains) employees in their pursuit of performance excellence. Therefore to take advantage of the creative potential of individuals, the companies must provide a context that nurtures and supports creative output.

7.2.4 Relationship Capital

The size and complexity of the projects at both ConsultCo and ResearchCo required them to use collaborative partnerships for exploiting external sources of innovation. In both companies, the members of the cross-functional teams and the collaborative business partners came into the project with their own unique knowledge bases, bringing 'requisite variety' (Nonaka and Takeuchi, 1995) into the project. However, the forms of the external relationships, the nature of knowledge exchange and the benefits gained varied significantly between the two case-study companies, as discussed below.

ConsultCo formed business partnerships through contractual linkages such as joint ventures. These linkages were designed to meet their strategic need for extending the company's profile of services offered to the customer. Therefore the strategic fit between the partners in the form of compatibility of vision and mutuality of purpose as well as trust and transparency played a key role in the success of the business partnerships. The joint working helped to internalise a partner's know-how through communication, learning and participation. For ConsultCo, the main benefits of collaborative partnerships were resource pooling, risk sharing and long-term exchange of know-how. The partnerships also gave ConsultCo the credibility needed to win customer contracts by gaining access to new capabilities, without incurring the costs involved to

develop these competencies in-house. Additionally, collaborative partnerships provided flexibility, as inter-company agreements were easier to dissolve than internal commitments.

In contrast, ResearchCo used alliances in a more limited way. The company sought access to technology advancements that complimented its internal R & D capability through collaborative partnerships that centred on scientific networks and research consortia of multi-firm and academic collaborations. The partners contributed to the creation and dissemination of new knowledge through joint research and working papers and gained privileged access to rapidly advancing areas of science that was available to the consortia members, thereby decreasing the development risk. Consequently, ResearchCo was exposed to the risk of collaborating with potential competitors. The benefits of external collaboration for ResearchCo included the gaining of new ideas for the innovative technology, access to technological advancements, influencing industry standards and the rapid commercialisation of the technology.

There were similarities in the way the two companies created value through collaborative *partnerships with their customers*. Both companies needed intimate and intense dialogue between the customer and the project team in order to articulate the real needs of the customer and the related stakeholders. The resulting insights provided the companies with the ability to translate the customer requirements into the development process and deliver highly customised products and services in ways their competitors could not. This observation is in line with the work of Payne and Holt (2001) who argue that a company's success depends on the extent to which it delivers value to the customer. Similarly Nonaka and Konno (1998) found that closeness to customer is a fundamental concept for creating new knowledge.

Thus, in both companies the delivery of innovative products and services required an effective strategic partnership with business partners and customers. It appears that the preferred structure of external business partnerships, the benefits gained and the nature of the knowledge exchange depend on the strategic need of the organisation. Consistent with this observation, Parise and Henderson (2001) found that capturing value from alliances is enhanced when an alignment between alliance strategy and business strategy is obtained. The partnerships in this research also seem to have many motives including access to complementary resources and technologies, reduced time to market and the long-term exchange of know-how. Similarly, Hagedoorn (1993) found that the most mentioned benefits between alliances were technology complementarity, innovation time-span reduction and market access. It is clear from the evidence discussed in chapters 5 and 6, that in addition to accessing complimentary resources and technological know-how, both companies used collaborations as an opportunity to learn new competencies and internalise the know-how that flowed between partners. This finding is consistent with the

recent literature that find that alliances are mechanisms for acquiring know-how and learning from other companies (e.g. Hamel, 1991; Hagedoon and Schakenraad 1994; Stuart, 2000).

It was evident in both companies that the external knowledge propelled internal knowledge forward, thus avoiding core competencies from turning into core rigidities as found by Leonard-Barton (1995). The evidence also shows that both companies achieved advantage in the marketplace by satisfying customer needs better than a competitor through their unique, idiosyncratic and therefore not easily transferable or replicable (Grant, 1996) knowledge resources. How the two companies utilised these knowledge resources to create value is compared and contrasted in the next sub-section.

7.2.5 Value creation from intellectual capital

Although both companies relied heavily on knowledge for their success, creating value through the delivery of a fundamental customer benefit was different for the two companies. ConsultCo sold their knowledge as a service, while ResearchCo packaged their knowledge into software. ConsultCo could not 'reuse' their knowledge as easily as ResearchCo digitising their invention into software. Thus, the two companies had different profiles for value creation.

However, it was evident that the two companies used similar processes for transforming knowledge resources into valuable products and services, which involved a continuous interplay among the human, organisational and relationship capital dimensions. This interplay, over time, embedded knowledge in organisational routines to develop capabilities that contributed to customer-perceived benefits. Building on the works of Amit and Schoemaker (1993), Grant (1996), Teece et al (1997), Eisenhardt and Martin (2000), this research has identified the integration mechanisms employed by the two companies to develop capabilities, into three broad categories based on their strategic roles. These are, *exploiting existing skills and resources, acquiring and internalising new knowledge from outside and accumulating firm-specific skills and resources*. It was evident that both companies used a combination of these integration mechanisms. The many examples of the integration mechanisms were described in chapters 5 and 6 and therefore aie not repeated here. Instead, the *mechanisms* observed within the two companies and *the impact* they created on the value creating process are discussed here.

First, both companies *exploited their existing internal knowledge.* For instance, both companies *combined* the experience, intellectual competencies and insights of its members through the close working relationships of the cross-functional teams. This process developed a high level of collective experience that translated into rapid response and problem solving capabilities, enabling the teams to resolve complex customer problems efficiently and

effectively. The dynamic interactions also created new knowledge that was applied to create new products and services.

In addition to combining knowledge, both companies *reconfigured* their existing knowledge to create new products and services. For instance, the project teams generated new combinations of their existing knowledge to make the choices that shaped the continual innovation. They responded to the rapidly changing markets by recognising the core organisational skills that related to advancing market needs. These areas of specialised knowledge were then integrated in new combinations, in order to evolve the respective products (many variants of the 3-D audio technology) and services (funding and risk management schemes for capital projects). The integration of multiple streams of knowledge to build new competencies implied a constant search for alternatives to current practices and procedures. These changes enabled future oriented activities to take place by eliminating outdated activities that failed to add value. Capturing lessons from both success and failure was also evident in the two companies where the lessons learned from previous activities influenced the reconfiguration of skills and knowledge, which added to the organisations' capabilities.

Consistent with these observations, a study of three Japanese companies by Nonaka and Konno (1998) found that organisational efforts to integrate knowledge possess the dynamism to continually create new knowledge. Similarly, Grant (1996) argues that the essence of organisational capability is the integration of individuals' specialised knowledge. Grant (1996) contends that due to the cognitive limits of the human brain, increased specialisation implies reduction in breadth of knowledge. However, the creation of value (transformation of input into output) requires a wide array of knowledge, gained through combining the specialised knowledge of many individuals. Moreover, Nahapiet and Ghoshal (1998) argue that four conditions must be satisfied for effective combination and exchange of knowledge. They are: accessibility to knowledge, the anticipation by the involved parties that combination will create value, the expectation that the parties will be able to share some of the value created through their engagement and the capability to combine information and experience.

Second, both companies **acquired and internalised new knowledge** from outside through their strategic business partners and customers. It involved abilities in selecting, negotiating and creating mutual benefits from the partnerships. Although the forms of partnerships of the two companies differed (e.g. joint ventures Vs. scientific networks), both companies facilitated the development of internal capabilities through their alliances. In addition to accessing complementary skills and resources, both companies used alliance partnerships as an inter-organisational learning opportunity. Bringing in knowledge from outside enabled ConsultCo to

broaden their knowledge base, while ResearchCo kept abreast of technology advances. Due to the inherent difficulties in the discovery and absorption of tacit knowledge, relationship management played a vital role in the nurturing of the partnerships. Hence, the integration of new knowledge from external partnerships required a rich pattern of communication, participation and trust building. It was evident in both companies that the intensity of the exchange of knowledge evolved over time through formal and informal processes. In both companies, the needs and aspirations of the customer formed the basis of shaping solutions. The close working relationships with the customer and related stakeholders ensured regular feedback that entailed taking action to resolve issues and tackle challenges as they emerged. Building new thinking in the light of new experiences and insights enabled the two companies to offer superior customer-perceived value. The relationship between innovation and external partnerships that was observed in this research is consistent with Powell et al (1996) who argue that inter-organisational learning networks provide the locus of innovation.

Third, it was evident in both companies that value creation resulted from a **cumulative resource development** process that led to a build up of firm-specific capabilities. In both companies, the current innovations were shaped by previous achievements, thus indicating a dependency on "history". The established knowledge base also provided an 'absorptive capacity' (Cohen and Levinthal, 1990), which enabled employees to recognise the value of external knowledge and add it to their own knowledge base. Several methods of knowledge accumulation were observed within the two companies. Both project teams continually enhanced their skills through learning by doing, both individually and collectively, which resulted in the specialised expertise of the two organisations. The explicit element of the knowledge was captured in documents and databases and diffused within the organisations through rules, procedures and operating guidelines. In addition, the two companies accumulated and held knowledge tacitly as a social collective, through joint contributions to problems and exchange of stories. Consistent with these observations, Prahalad and Hamel (1990) note that capabilities based on accumulated knowledge are difficult to imitate by competitors as they involve organisational routines, culture and collective learning. Similarly, firm-specific history has been highlighted by Nelson and Winter (1982) as a critical factor in explaining firm level differences, making it difficult to replicate by competitors.

The above discussions show that the two companies developed capabilities by integrating a variety of skills, resources and technologies. Examples of capabilities evident in the two companies include new product and service development capability supported by customer responsiveness capability, alliance capability, R & D capability and the capability to provide superior quality of service to the customer. Since capabilities involve complex patterns of co-

ordination between people and other resources, they are developed over time through collective learning within the organisation (Grant, 1991).

Thus, although the two companies had different profiles for value creation, this research has attempted to identify the common characteristics of the three broad mechanisms employed by the two organisations to develop core capabilities that drive value creation. The integration mechanisms facilitated the exploitation of existing knowledge and the development of new knowledge. These mechanisms, due to their company-specific nature, combine skills and resources in ways that are difficult to imitate by competitors. The development of core capabilities required other organisational attributes such as managerial competencies, shared values and beliefs and an organisational orientation that stimulated innovation.

Table 7.1 summarises the two cases identifying key characteristics on a comparative basis.

Characteristics	ConsultCo	ResearchCo
Human Capital	High domain relevant skills and experience	High domain relevant skills and experience
	Varied social and political skills across the project group	Varied social and political skills across the project group
	High dependence on individual knowledge	High dependence on individual knowledge
	Collective knowledge restricted to collectively held tacit knowledge	*High emphasis on organisational memory in the form of electronic databases as well as socially embedded knowledge*
	High level of creative problem solving coupled with *the need to work within rules and guidelines*	High level of creative problem solving
	High intrinsic motivation supported by extrinsic motivators	High intrinsic motivation supported by extrinsic motivators
Organisational Capital	Opportunity for creative expression and recognition of contributions identified as present within the company and stimulating innovation	Opportunity for creative expression and recognition of contributions identified as present within the company and stimulating innovation
	Constraining factors regarded as not posing a threat to innovation	Constraining factors regarded as not posing a threat to innovation
	Limited physical resources identified as *an impediment* to innovation	*Adequate physical resources – influence not known*
	High organisational orientation to innovation	High organisational orientation to innovation
	Supportive organisational structure, including inspirational and visionary leadership	Supportive organisational structure including inspirational and visionary leadership
Relationship Capital	Many *long-term business partnerships* for exploiting external intelligence	Business partnerships limited to *research networks and consortia* for exploiting external intelligence
	Benefits identified as *resource pooling, risk sharing, exchange of know-how, flexibility*	Benefits identified as *gaining new ideas, access to technological advancements, influencing industry standards, rapid commercialisation*
	Intimate and intense dialogue between the customer and the project team	Intimate and intense dialogue between the customer and the project team
	Customer relationships led to a unique *service*	Customer relationships led to a unique and *evolving product*
Integration Mechanisms	Combine existing knowledge	Combine existing knowledge
	Acquire new knowledge	Acquire new knowledge
	Accumulate knowledge	Accumulate knowledge

Capabilities	New service development capability	New product development capability
(Examples)	Customer responsiveness capability	Customer responsiveness capability
	Strategic alliance capability	*R & D capability*
	Quality of service	Quality of service
	The ability to form effective teams	The ability to form effective teams
Product/Service	*Professional service*	*High technology product*
	Knowledge as a process	*Knowledge as digitised code*

Table 7.1: Summary of Cross-case Comparison

By analysing the major similarities and differences in the way intellectual capital factors impacted on innovation within the two companies, this research was able to better understand the process of value creation. The inferences drawn are used to put together a set of practical guidelines in the form of a framework for value creation as discussed in the next section.

7.3 A Framework for Value Creation

Based on the findings in chapters 5 and 6, and the cross-case comparison in section 7.2, a framework for value creation is set out below and visualised in Figure 7.2. The framework consolidates the views from the theoretical models discussed in chapters 2 and 3. As discussed in chapter 2 (section 2.7), there are many forms of value and therefore many approaches to value creation. The focus of this framework is on developing an innovative capability that derives value in the forms of strategic benefits, sustainable revenue streams and market capitalisation. However, it is not concerned with the organisations' strategic plan, financial metrics or performance measures.

The framework classifies the characteristics of a value creating process under the attributes of: human capital, organisational capital, relationship capital and the resulting capabilities, which are represented by the boxes in Figure 7.2. Within this classification, each attribute is mapped explicitly to the value creating process. The solid arrows represent the value-creating path while the broken arrows indicate the impact of the individual IC dimensions on innovation and value. Innovation is the means by which intellectual capital creates new wealth. Figure 7.2 illustrates this study's findings and Edvinsson and Malone's (1997) argument that organisational value does not arise directly from an individual IC dimension, but from the interaction between all of them. It is this interaction that develops capabilities required for innovation. This implies that a weak IC dimension or a weak flow between them will have an adverse effect on the organisation's ability to create value.

The paragraphs below discuss the main attributes of the framework. The constructs that were found to drive value within the two case-study companies are set out and serve as signposts to the important areas of attention within each attribute. The framework attempts to reveal important areas of attention rather than provide an exhaustive list of constructs that impact on innovation. Although the attributes are separated for analytical purposes, it is important to recognise that both the attributes and their impact are, in fact, highly interrelated.
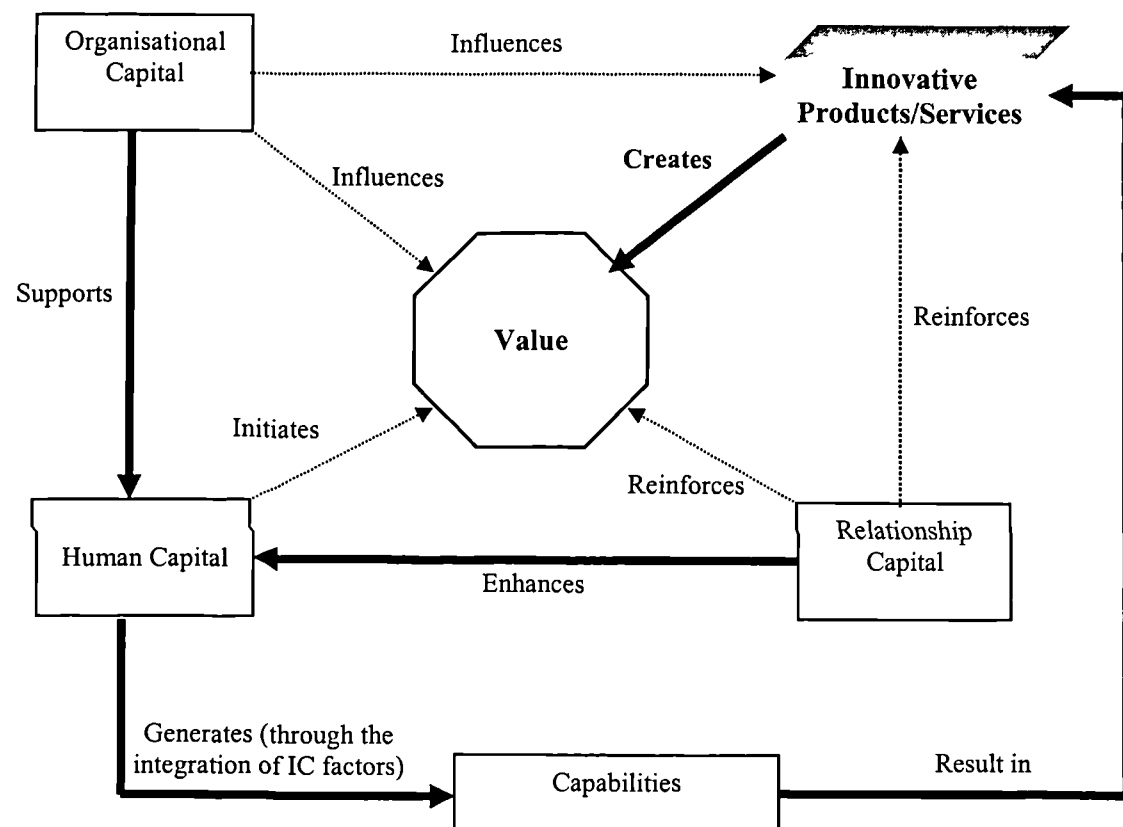
Figure 7.2: A Framework for Value Creation

The starting point for this framework is purely arbitrary. The discussion here starts with the human capital attribute. The focus however, should be on all the IC dimensions for the reasons discussed above.

Attribute 1: A Focus on Human Capital

Human capital represents an organisation's innermost potential to create unique value for customers and comprises of the individual and collective intelligence of the organisation. Human capital is the dimension most often associated with core capabilities. Individuals generate value for the organisation through their competence, creativity and interdisciplinary work. Consequently, they use their individual expertise and skills and collaborate with colleagues and customers in order to provide intelligent solutions to the customers' unique needs. This requires a broad spectrum of knowledge, ranging from technical skills to business and social skills. For this reason, it is important to balance the work teams to ensure a good blend of skills and profiles is present. Also important is the matching of individuals to work assignments on the basis of both skills and interest to enhance motivation and creativity. Once the appropriate competencies have been identified they need to be channelled toward products and services that add value to customers.

A set of procedures needs to be established to align individuals with each other and with the organisation in order to encourage creativity, innovative attitudes, interdisciplinary thinking, and co-operative behaviour. These need to be continuously adapted to achieve organisational goals. The interrelating between project or organisational members will lead to a shared vision and the tacit understandings of the organisational dynamics thereby developing an appreciation of the ways in which value is created. Thus a focus on human capital facilitates the development of firm-specific skills and enhances the employee commitment to co-produce the value of the business, which can have a positive impact on the retention of employees.

Key human capital constructs that drive value creation

Domain specific skills - *Do individuals possess the technical skills required by the market?*

- Education – familiarity with facts and information of the domain

- Expertise – deep technical knowledge acquired through training and practice

- Experience – practical knowledge developed through training, reflection, mistakes, repetition

- Problem solving skills – the ability to evaluate a problem situation

Context specific skills - *Do individuals possess the business and social skills necessary to achieve the task/project objectives?*

- Interpersonal skills

- Social and political influence

- Inspirational leadership skills

- Project management skills

Creativity - *What opportunities are there for meaningful and stimulating work that enhance the cognitive and behavioural characteristics of individuals?*

- Thinking skills for taking new perspectives on problems

- An energetic pursuit of one's work

- Intrinsic motivation - interest, involvement, satisfaction in the work

- Personal orientation - readiness to entertain new ideas, independence of judgement

- A sense of challenge

- The heuristic nature of the tasks

Firm-specific collective knowledge – **How d**o *individuals contribute to the collective knowledge of the project/organisation?*

- Cross-functional teams to ensure the correct mix of skills

- Formal and informal networks of relationships

- Tacit understandings of different perspectives

- Collective learning that build on the creative ideas of one another

- Shared values that encourage co-operative behaviour

Attribute 2: A Focus on Organisational Capital

The value-creating potential of human capital can be influenced by a multitude of factors within the organisational context. The conditions under which a person works, the organisational systems that recognise and support innovation and the flow of knowledge through the organisation can significantly affect the level of creativity, motivation and innovation. This requires that senior managers step up to the challenge of growing intellectual capital through supportive management practices that encourage shared vision, collective learning and organisational routines for approaching ill structured problems. It is important to develop a strong culture with shared value systems that appreciates one another's needs, objectives and

competing perspectives. Similarly, articulating the goals and vision clearly will stimulate a willingness to search for opportunities.

Key organisational capital constructs that support value creation

Enabling conditions - *What environmental stimulants are available within the organisation?*

- Opportunities – autonomy, requisite power to act, feedback, leadership support, team support

- Absence of constraints – lack of motivation, control and interruptions, organisational resistance

- Resources and support – funds, time, IT, information

- Rewards and incentives – recognition, acknowledgement, financial incentives

Organisational orientation - *How is innovation promoted within the organisation?*

- Top management commitment and support to the innovation process

- A formal innovation approach

- A capacity for organisation-wide problem solving

- Co-operation and collaboration across levels and divisions

- A sense of pride in the organisational members

Organisational structure - *How is innovation supported in the organisation?*

- Facilitate close working relationships to embed tacit knowledge within the collective

- Cultivate a culture that values diverse perspectives

- Investment in team-building to encourage co-operative behaviour

- Networks and communities of practice for knowledge exchange and integration

- Collective learning opportunities

- *Carefully designed* reward and incentive schemes

- Availability of flexible structures and procedures

- Management practices – inspirational leadership, vision, clear goals, strategic focus

Attribute 3: A Focus on Relationship Capital

Co-operating with other organisations to internalise, enhance or develop capabilities concern what knowledge the organisation can gain from the external sources and how the learning can be transformed into action that creates value. When organisations collaborate to achieve a jointly shared outcome, they realise a synergistic value that exceeds the value either could generate independently. The potential for value creation depends on many factors that can influence the formation, nature and outcomes of external partnerships. The challenges facing the organisation are the careful section of the partners, negotiation of benefits and managing the complex inter-organisational relationships. Alliance relationships involve selected employees from all parties working together. Consequently, actions must focus on building effective working relationships between the partners through trust, reciprocity and transparency, in order to achieve maximum benefits from the partnerships. The relationships, if managed carefully,

will enable all involved parties to capitalise on the others' specialised knowledge. However, internalising a partner's knowledge requires the development of an appreciation and understanding of the other's knowledge. Similarly, strategic partnerships with customers provide an important source of innovation. Close relationships with customers with a high exchange of knowledge and insights create capabilities that are slow to accumulate and therefore difficult to imitate by competitors.

Key relationship capital constructs that strengthens value creation

Collaborative working relationships with business partners – *What are the conditions necessary for the business partnerships to function and how effective are the partnerships?*

Formation

- Align alliance strategy with the business strategy – what linkages are necessary?

- Select partners carefully – consider the capabilities, compatibility of vision and mutuality of purpose

- Identify a set of agreed upon goals

- Identify benefits to be accrued to each partner – intellectual property rights, income, exchange of knowledge

- Establish effective working relationships – communication patterns, accountability

Nature

- Locus of innovation – co-development of product, service or technology

- A learning opportunity – cyclical patterns of learning, receptivity to external knowledge

- The extent of trust and transparency

Outcomes/Motives

- Synergy

- Access to new resources and capabilities

- Risk sharing

- Internalisation of know-how through communication, participation and learning

- Reduced time to market

Collaborative working relationships with customers – *What processes are in place to create value for the customer and how effective are they?*

Formation

- Strategic partnerships with customers

- Licensing agreements

Nature

- An important source of innovation - co-development of customer-specific products and services

- An opportunity to develop relationships with all customer-related stakeholders

- A learning process that is used to modify how actions are carried out in the future

- An opportunity to assess the impact of the product or service to the customer

Outcomes/Motives

- Hands-on interaction for developing new products

- Regular feedback leading to product design insights

- Close collaboration with users over the products' conceptualisation and operationalisation

- Improved customer service

- Customer satisfaction

- Customer retention

Attribute 4: A Focus on Capabilities

Developing capabilities requires the integration and accumulation of knowledge from within and outside the organisation. The integration of knowledge resources, concurrent with market changes develops dynamic capabilities, which enable the creation of new knowledge. Hence capabilities are embedded in organisational processes. Due to the idiosyncratic nature of each firm's processes and the uniqueness of their knowledge resources, it is impossible to set out specific approaches for developing capabilities. However, there are significant commonalities across firms in the way capabilities are developed. This research identifies several common features across the three broad mechanisms for integrating knowledge resources. The view of this research is that firms can apply these integration mechanisms to create effective, yet highly differentiated approaches.

Key integration mechanisms that develop organisational capabilities

Combine and reconfigure existing skills and resources - *What are the possibilities for putting existing knowledge to more profitable use?*

- Identify and integrate skills and resources that contribute to customer-perceived value
- Search for alternatives for current practices and procedures to discover unexplored potential of the available knowledge resources
- Encourage active participation of individuals from different disciplines and functions
- Co-ordinate multiple streams of knowledge and technologies in new combinations
- Identify and eliminate outdated activities that fail to add value

Acquire and internalise new knowledge from outside – Is there the potential for more value creation through external partners?

- The role of the partners – customers, suppliers, complementary resource holders, competitors
- Alliance partnerships as an opportunity to learn
- Exchange of tacit, specialised knowledge and skills
- Effective external relationships
- The ability to absorb new knowledge

Accumulate firm-specific skills and resources – what strategies and processes are needed to shape the strategic direction of the organisation?

- Current endowments
- Choices about which paths to follow – strategic direction
- Learning by doing
- Embed knowledge in organisational routines, culture and processes
- Tacitly held knowledge in a social collective
- Capture explicit knowledge in documents and databases
- Capture learning from previous activities, both successes and failures

The above guidelines were designed to provide helpful pointers for identifying and developing intellectual capital resources and dynamic capabilities in a way that provides an organisation with a sustainable competitive advantage, and thereby, value.

7.4 Applicability of the Framework

The framework outlines two aspects of value creation. First it illustrates the key elements of intellectual capital that impacted on innovation. Second, it describes the integration mechanisms that were found to develop capabilities that drive innovation and thereby value creation. The impact of these attributes was demonstrated at the project level (chapters 5 and 6). Therefore, the framework does, to some extent, construct a profile of a successful project team. However, the cross-functional involvement and the strategic nature of the two projects studied in this research means that the characteristics and practices found at the project level parallel those at the organisational level. Hence the framework also contributes towards a better understanding of the nature of the intangible resources within an organisational context and allows decision-makers to clarify the requirements for successful innovation in terms of resources, processes and capabilities. More specifically, the framework could be used to:

- Assist in developing the effectiveness of project teams – the set of factors can be used as a starting point for discussions in addressing the project related skills and processes in a supportive and constructive manner. Also the proposed framework improves the project management sophistication since it contributes to understanding the factors that influence the success of innovation projects.

- Build a road map – the framework can be used to provide a snapshot of what is currently available to the organisation in terms of the intangible success factors that drive innovation. This internal visibility allows building a road map that connects one element of intellectual capital with another and highlights the organisational processes that are required to enhance the flow of knowledge resources. Since value is created only when IC factors are combined and utilised, the key integration mechanisms that describe how the resources are employed to create value form an important element of the framework.

- Enable linking intellectual capital with the organisation's strategy – the framework attempts to provide a holistic picture for the organisation in terms of knowledge by identifying the key IC factors that are needed for innovation. The comprehensive list of theoretically argued and empirically validated factors can be used to formulate a management agenda, which would help focus on the strategic capabilities required by the organisation. Analysing

the strengths and weaknesses of IC factors and organisational processes can provide important information to see how these can positively affect an organisation's business strategy. The identification process will highlight what products and services the organisation is able to offer to the market in the light of the current and future trends in the industry.

- Assist in identifying the nature and effectiveness of intellectual capital factors - the framework can be integrated into or used in parallel to the management information systems and can be used to develop performance indicators and intellectual capital statements. The framework describes the resources that an organisation needs to devote to its innovation process, enabling managers to get a structured view of how the organisation's resources and capabilities create value.

- Assist in creating the right conditions for innovation and value creation – the identification of a number of factors that influence innovation is not a new concept. However, their dynamic interrelationships are not well understood. The framework attempts to shed light on the linkages, interactions and the complementarity of various IC factors to generate value. Access to external knowledge for example, both increases the opportunity for learning and reduces the time to market. At the same time, the ability to internalise this new knowledge depends on the organisational members' 'absorptive capacity' and learning capability.

- Pinpoint areas of attention – the framework can be used to give managers more insight into the activities to see what they did right and wrong in the case of particular innovations and can act as a guide to continuous improvement of innovation management. It can also be used to provide a shared understanding of the key drivers of value and the value creation process among the project team.

The advantages of the framework are that it can create a more comprehensive picture of an organisation's value creating potential than financial metrics and that it can easily be applied at both the project level and at the organisational level. This will allow organisations to more effectively allocate resources for the development of required capabilities. Since the framework does not involve any financial measures, it is useful for non-profit organisations, internal departments and public sector organisations.

The disadvantages of the framework are that the indicators are contextual and have to be customised for each organisation and each purpose.

It is important to note that the set of constructs has not captured every detail of intellectual capital. Instead, the framework provides an overall picture of the IC and value generation and can be considered as a starting point for a deeper exploration of the factors that affect innovative performance.

Although the simplicity of the framework allows easy application in real-life, the time required to develop the capabilities and the complexity of the social processes required to develop them may make the implementation of the framework a challenge. A further challenge is to know *what* the salient contextual features of IC are that shape value creation and *how* the shaping emerges and its impact on the organisation. Nevertheless, organisations may find value in seeking to adapt the framework to their unique contexts.

7.5 Implications for Practice and Theory

With previous research having established a link between intellectual capital factors and value creation, this research described *how* intellectual capital could be used to create value. The findings of this research have several implications for knowledge-intensive organisations.

Intellectual capital is defined as the combination of human, organisational and relationship capital and this study has shown that value is created at various levels, in the connectivity between these forms of capital. Therefore the transformation of intellectual capital into a process, capability, product or service will create value directly or subsequently for the organisation. This implies the need to put mechanisms in place to focus, co-ordinate and integrate the various knowledge resources to achieve the strategic goals.

Although there are common issues to be confronted and a common set of principles for dealing with intellectual capital, it was evident that intellectual capital is context specific. Therefore each company must find its own particular solution, adapting and aligning intellectual capital with business objectives derived from the organisation's vision and strategy.

The study suggests that employee competence and know-how are pivotal factors in innovation. However, it was clear that simply having knowledgeable individuals did not lead to superior innovative performance as innovation (technological innovation at ResearchCo and service innovation at ConsultCo) did not depend on any one person but required continual insights from a variety of perspectives. This implies that value creation depends on two key aspects: the

quality of intellectual resources and the integration mechanisms that combine the resources to achieve desired outcomes.

When the primary resource of the organisation is knowledge, the primary task of management becomes establishing the co-ordination necessary to integrate and develop this knowledge that is residing in individuals into capabilities, goods and services. Organisations that nurture the intrinsically motivated creativity of individuals are likely to develop a strong innovative capability.

The first step towards building any organisational capability is self-assessment, which requires organisations to assess their own strengths and weaknesses. For this purpose organisations need a framework for visualising intellectual resources. Without a framework that describes the resources and capabilities that drive value creation within the particular business environment, it is difficult to focus effectively on IC value drivers and make them part of the daily business activities.

Findings revealed that capabilities are built through a process of continuous interaction among the intellectual resources over a long time span. This observation has three important implications. Firstly, a company that has failed to develop capabilities will find it difficult to respond quickly to an emerging market. Secondly, this means that capabilities do not exist as isolated resources but are related in a network of intangibles. Thirdly, since integration is the distinguishing hallmark of capabilities, it is unlikely that capabilities will reside in their entirety in an individual or a small team (Hamel, 1994).

Given the suggestion of this research that innovation creates value for businesses, it seems logical to assume that innovation equates to successful business performance. However, it should be emphasised that successful business performance does not solely depend on innovation. Therefore, success in innovation should be viewed as necessary but not sufficient for successful business performance and growth.

The study highlighted the need to identify further relationships and linkages between the IC dimensions. These theoretical implications will be discussed in detail in the next chapter under future research.

7.6 Conclusions

This chapter compared and contrasted the impact of IC factors on two innovative projects in order to understand the process of value creation. Both projects have been regarded as successful by the respective companies. Examining the propositions of the research model within the two case-study companies enabled the validation of a comprehensive set of IC factors and their integration mechanisms that drive innovation success. The results have been presented in the form of a framework for visualising intellectual capital that effect innovation. The framework represents two aspects of value creation. First, attributes 1 - 3 illustrate the specific elements of IC that impacted on innovation. Second, attribute 4 describes the interrelationships between the various elements of IC by outlining the integration mechanisms that developed capabilities. Therefore, the applicability of the framework, as discussed in section 7.4, centres on its use as a set of key indicators that provide an overall picture of the current state of IC and value generation within an organisation or a project team. The framework could act as a starting point for a deeper exploration of the operational aspects of a project team that would focus on the key criteria for success and identify changes needed to increase value creation. The findings of this research highlighted several implications for theory and practice. The managerial implications are discussed in section 7.5 while the theoretical implications are discussed in chapter 8 under future research.

Conclusions

8.1 Introduction

This final chapter concludes the research carried out in this dissertation. The purpose of this chapter is twofold: (a) to summarise and evaluate what has been achieved throughout the process of this research and (b) to propose areas of future research. Section 8.2 provides a brief summary of the dissertation. Section 8.3 sets out the main findings and the contributions of this research. Finally, section 8.4 discusses the limitations of the research and from the issues raised, areas for further research are identified.

8.2 Research Overview

Chapter 1 served as an introduction to the research topic, outlining the aims, objectives and motivations that guided the scope of this thesis. The main work of this research stems from the observation that utilising intangible resources to create organisational value presents a significant management challenge that has not been addressed sufficiently in the literature. It was argued that although the previous research has established the positive relationship between intellectual capital and organisational value, how the relevant elements of IC can be defined, developed and deployed are presently not well understood. Therefore the aim of this research was *to investigate how intellectual capital impacts on value creation within organisations*. In doing so, resulting in the development of a framework for describing the core elements of IC and how they interact to create value. The focus for the study was framed in the form of three research questions:

- How does a particular enterprise create value?
- How do the different elements of IC contribute to that value creation?
- What characteristics of IC are common across different organisations?

Chapter 2 was concerned with the background theory. An extensive review of the literature in the areas of intellectual capital, innovation, creativity, organisational theory and strategic management was carried out. The purpose was to evaluate the theories and concepts that undergirded the context of intellectual capital, establishing the timeliness and the significance of this research to practice and theory. The review presented evidence to highlight the role of a firm's intangible resources as the foundation for its long-term survival and growth. A second observation with respect to intellectual capital resources addresses their nature and character that when a company is valued in excess of its book value, the difference is attributed to the wealth-creating potential of the company's intangible resources that are not identified on the balance sheet. Since the stock market seems both to recognise intellectual capital and assign a quasi-value to it, several models have been developed to measure and link intellectual capital to stock market value. Finally, a critical evaluation of these models revealed their inappropriateness for understanding the elements of intellectual capital and how they create value for the organisation. It was also established that empirical support is lacking for the synergistic relationships among the intellectual capital factors within an organisational context.

Chapter 3 set out the focal theory. The chapter presented and justified a theoretical model in order to address the issues raised in Chapter 2. As innovation is widely agreed to be a determinant of organisational value creation, this research used the model of intelligence and innovation developed by Glynn (1996) as the starting point for the theoretical development. The model proposes that innovation within organisations is a function of individual efforts and institutionalised processes to facilitate value creation. This study identified a possible weakness of the original model in that it did not explain the impact of the external intelligence on innovation. For this reason, this research extended the original model to include collaborative business intelligence. Secondly, as the focus of this research is on intellectual capital, the chapter de-contextualised the ideas, constructs and relationships of the original model from a psychological perspective to an intellectual capital perspective. Thus, a novel and comprehensive theoretical framework was developed for presenting an integrated analysis of the elements of IC. The model specified six key propositions and three sub-propositions.

Chapter 4 presented the data theory. A research methodology was developed to justify the relevance and validity of the empirical data that supports the thesis. It was argued that quantitative methods such as survey-based research do not capture the complexity associated with intangible resources and their sensitive and consequential nature. For this reason, a qualitative, interpretive approach involving case study research was proposed for investigating the intangible resource-base of the two selected companies.

Chapters 5 and 6 continued with the data theory. These two chapters presented and analysed contextually rich data specific to two projects and examined the interrelationships and the link between the elements of IC and value creation in two innovative contexts.

Chapter 7 presented the two main contributions of this research. First, the chapter conducted a cross-case analysis of the two case studies in order to compare and contrast how the various IC elements contributed to value creation within the two organisations and provided a synthesis with the literature. Secondly, the chapter developed a descriptive framework for value creation that is informed by the findings of this research. The potential benefits that might be realised from applying this framework were also discussed. Thus, this research has achieved the aim of this thesis as identified in chapter 1.

8.3 Research Findings and Contributions

This section firstly presents the main findings derived from the work presented in this thesis and then sets out the contributions of this research.

8.3.1 Main Findings

The findings of this research are based on an in-depth study of two innovative projects. This research explored the concepts relating to intellectual capital that has been published thus far and extended these through empirical analysis. Based on innovation theory, this research identified individual and organisational characteristics that can drive value creation and illustrated their interrelationships through two case studies. It is this focus on the interrelationships of IC factors that differentiates this research from the others. The research questions posed in chapter 1 (section 1.3) are revisited in this section in order to demonstrate the extent to which this work has been successful in addressing the points raised.

RQ1 – How does a particular enterprise create value?

In order to answer this question, it was necessary to define 'value'. It was argued in chapter 2 (section 2.7) that the essence of value is the prospect of benefits. The benefits created by the two companies were established both from the perspective of the customer (the extent to which the customer appreciated the benefits) and from the perspective of the company (the stream of future benefits that IC and the strategic capabilities it created will bring to the organisation). The benefits identified were both financial and non-financial. These were discussed in chapter 5 (section 5.6) and chapter 6 (section 6.6) respectively.

The review of the literature highlighted that there are many forms of value and many approaches to value creation. Therefore, the definition of value creation and the value drivers used to sustain it differ among organisations. The evidence in this research indicates that the two organisations created value through the delivery of a fundamental customer benefit that was competitively unique. They achieved this by the continuous development of innovative products and services that were significant to customers. Although both companies relied heavily on knowledge resources to create value, the two companies had different profiles for value creation. For instance, ConsultCo sold their knowledge as a service, while ResearchCo packaged their knowledge into software.

RQ2 – How do the different elements of IC contribute to that value creation?

Following on from the above, the primary role of intellectual capital for both companies was to create innovations (putting new ideas into practical use). How each element of IC contributed to value creation was specific to each company. These were described in detail in chapters 5 and 6, with a cross-case comparison in chapter 7 (section 7.2). The evidence suggests that the value impact of each IC element is related to its quality. Furthermore, both the level of skill and the market's demand for what that skill produces determine the contribution to value made by individuals' competencies.

The empirical examination illustrated that value does not arise directly from an individual IC factor, but from the interaction between them. Value creation was intimately tied to each company's routines and practices that determined how the individual IC factors were integrated. The two companies integrated their stocks of knowledge resources in ways unique to the individual company, which involved a continuous interplay between the human, organisational and relationship capital dimensions. These complex patterns of interaction, over time, embedded knowledge in organisational routines to develop capabilities that contributed to customer-perceived benefits.

Although the two companies had different profiles for value creation, this research identified three broad categories of integration mechanisms that were common across the two companies. These integration mechanisms are a) exploiting existing skills and resources, b) acquiring and internalising new knowledge from outside and c) accumulating firm-specific skills and resources. Evidence suggests that companies use a combination of these mechanisms. How these mechanisms are deployed within each company shapes the commercial success of the organisations.

RQ3 – What characteristics of IC are common across different organisations?

Since IC resources are often internally generated and continually developed through the organisational routines and processes, they are unique and firm specific. The empirical examination observed that this uniqueness has given rise to two main characteristics of IC that were common across the two organisations. These characteristics have been identified in recent theoretical work on competitive advantage (e.g. Collis and Montgomery, 1995; Teece et al, 1997).

Inimitability – Because intellectual capital resources and the resulting capabilities were developed through the interaction of several resources over a time span, the processes by which they were developed were ambiguous. Inimitability arises from this ambiguity about what the composition of resources is and how they interact to create the product or the service.

Transferability – intellectual capital is embodied in highly tacit human skills that are difficult to define. The tacit nature of IC could also result from the firm-specific idiosyncratic learning (e.g. market knowledge derived by experience with the customer) that accumulates within the organisational collective. IC resources are not freely transferable between groups and between firms due to their high tacit content.

8.3.2 Research Contributions

This study makes a clear contribution to the normative literature through the development of a novel and comprehensive theoretical framework and the testing and validating of this framework based on two in-depth case studies. In this respect, this research de-contextualised an *established and respected theoretical model* developed by Glynn (1996) that has been well grounded within the psychology literature. In doing so, allowing this research to re-form the theoretical model to an intellectual capital context. In addition, this research extended Glynn's (1996) model of intelligence and innovation to incorporate intelligence at a third dimension – collaborative business intelligence. The relationship between innovation and collaborative business intelligence was argued and supported by a proposition (proposition 6). By examining the propositions of the research model within the two case study companies, this research validated a comprehensive set of IC factors and their integration mechanisms that drive innovation success. The cross-case analysis that compared and contrasted the impact of IC factors on value creation within the two companies provided a basis for developing one overarching set of guidelines. By investigating how IC factors impact on value creation this research facilitated the understanding of two aspects of value creation. First, the research explored the incidence of value creation due to the existence of specific types of firm-specific

intellectual resources. Second, the research examined the interrelationships between the various IC factors that enabled value creation, through the development of capabilities.

8.4 Limitations and Further Research

This research is subject to a number of limitations that present opportunities for future research as discussed below:

The focus of this study was the projects rather than the organisations. Focusing on the project as the unit of analysis limits the generalisability of the implications. However, focusing on the projects allowed a more thorough analysis of the processes, their dynamics and the underlying events, thereby increasing the robustness of the findings. Most specifically, a project level perspective on organisational innovation linked individual level factors such as interpersonal relationships to organisational outcomes. Furthermore, the cross-functional and strategic nature of the two projects meant that their successful implementation required the integration of the unique capabilities of the whole organisation thereby involving the wider context of the organisation.

This research has focused on innovativeness as a driver of value creation. However, business survival and growth are not outcomes due solely to innovation. Thus, one avenue for future research would be to examine the validity of the framework on other forms of value creation such as productivity improvements or strategic positioning through market leadership.

Although this study has provided a holistic IC perspective of innovation by capturing the widely cited potential IC factors that drive value creation, it is important to recognise that there may be other drivers or inhibitors of innovative performance that this framework does not take into account. For example, individual constraints that result from the emotional and motivational states of individuals such as depression, elation, feelings of helplessness and concentration patterns have been shown to impact on innovation. Additional research will be required to describe and empirically examine these other IC attributes and their relationships to the value creating process.

The empirical examination of this research was limited to two case studies. However, the two sites were carefully selected to include high and low technology as well as radical and incremental innovations within two different industry sectors. The findings show that the impact of IC factors is affected by the context of the firm, industry and technology in which the intellectual capital factors are employed. For instance, individual creativity had a high impact in a research organisation, while its impact was low in a professional practice. Therefore, further

empirical research across a broad spectrum of organisations and industries would be necessary to validate these initial findings and to establish the extent of the generalisability of the findings.

The small to medium nature of the two organisations in this study meant that the cross-functional nature of the two teams studied did not extend to cultural or geographical diversity. This may have limited the study's ability to recognise the negative consequences of high levels of diversity within innovative teams. Thus, a further avenue for future research would be to replicate this study using firms varying in size.

Finally, the framework developed in this research does not provide a model that takes inputs (e.g. IC factors) and produce outputs (e.g. organisational value). However, it is hoped that its elaboration of the individual attributes of resources and capabilities that are necessary for innovation will help the users think deeply about how the various elements of IC can be combined to produce value for the organisation.

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Appendix A: Interview Guide

This section presents the interview schedule that was used as a guide for questioning the informants (key project members) in the two organisations. 23 separate questions were designed to examine each of the 6 propositions and 3 sub-propositions. Two of the questions also related to the assessment of innovativeness and value creation. The same interview guide was used in both organisations with minor adjustments to questions to better align to the context of the organisation.

Interview Guide

Evaluation of intellectual capital factors that impact on value creation in knowledge-intensive organisations

The questionnaire aims to gain **the perceptions of key team members** in order to:

- Determine how intellectual capital influences innovation

- Identify how core competencies develop and evolve within the company

- Identify what factors affect individual creativity

- Determine the social environmental factors most strongly associated with innovation and thereby with value creation

For the purposes of this research the following **definitions** are used:

- **Innovativeness** – is the results-oriented problem solving (better ways to do the work).

- **Innovation** – is the process of bringing new problem-solving ideas into use.

- **Intellectual Capital** – is knowledge that can be converted into profit. It is the sum of a firm's ideas, technologies, skills, processes, creativity and general knowledge.

- **Knowledge intensive companies** – companies that use their knowledge (intellectual capital) as a major source of competitive advantage.

Company Name: _____

Company Address: _____

_____

Respondent's Name: _____

Position: _____

Project Title: _____

1. **How important is innovativeness (the ability to create novel solutions) to your company's overall success? Please tick/circle the number.**

(Value Creation)
(The question identifies whether the company's success is dependent on innovativeness)

	Very Low	Low	No impact	High	Very High
Importance of innovativeness is	1	2	3	4	5

2. **How would you rate the extent of the project's innovativeness? Please tick/circle the number.**

(Value creation and part of Prop 3a)
The question ascertains the extent to which the project created value in terms of,
a) The degree to which the project reflects creativity and innovativeness;
b) The benefit provided to the customer;
c) The lead the company has over its competitors (sustainability of value).

	Disagree strongly	Disagree	Not Known	Agree	Agree Strongly
The concept behind the service is new	1	2	3	4	5
The service provides a benefit unavailable previously to the customer	1	2	3	4	5
Customers think the company is different to the competition, rather than just better	1	2	3	4	5
The benefit offered goes beyond just "nice to have" i.e. substantial benefit	1	2	3	4	5
Customers will continue to benefit from the service for the foreseeable future	1	2	3	4	5

3. **How would you rate the achievement of the following project outcomes?**

(Value Creation)
(The question determines the extent to which the project created value, in terms of the benefits gained by the company)

	Very Low	Low	Medium	High	Very High
Degree to which the project meets revenue goals	1	2	3	4	5
Degree to which the project achieved customer satisfaction	1	2	3	4	5
Degree to which the project provides competitive advantage	1	2	3	4	5
Degree to which the project allows new markets to be entered in the future	1	2	3	4	5
Degree to which the company enhanced its reputation that can be illustrated with articles in trade journals, patents etc.	1	2	3	4	5
Degree to which the project facilitated "learning" for future efforts	1	2	3	4	5

4. To what extent did the following factors influence the project's competitiveness?

(Prop 2)
(The question investigates the extent of the collective organisational knowledge in terms of accumulated core competencies)

	Very Low	Low	Medium	High	Very High
Industry recognised unique competence of the project team	1	2	3	4	5
The company's stock of skills evolved from its past achievements	1	2	3	4	5
The company's core competence is difficult to copy by the competitors	1	2	3	4	5
Ability to form strategic partnerships with technology partners	1	2	3	4	5
Values and norms of the project team	1	2	3	4	5

5. To what extent did the following factors influence your work in the project?

(Propositions 1 and 3a)
(The question ascertains how types of intelligence and personal attributes contributed to the project outcome).

	Very Low	Low	Medium	High	Very High
Expertise in the specific field	1	2	3	4	5
Previous experience	1	2	3	4	5
Professional education and training	1	2	3	4	5
Intuition	1	2	3	4	5
Problem-solving/Creative thinking skills	1	2	3	4	5
Your social and/or political influence	1	2	3	4	5
Your interpersonal relationships	1	2	3	4	5
Your persuasive skills	1	2	3	4	5
Persuasive skills of others	1	2	3	4	5

6. What level of support did you have during the project, in terms of:

(Prop 4)
(The question ascertains how enabling conditions contributed to the project outcome, in terms of motivating the team members)

	Very Low	Low	Medium	High	Very High
Operational autonomy	1	2	3	4	5
Requisite power to act	1	2	3	4	5
Leadership support to address problems	1	2	3	4	5
Shared team experience	1	2	3	4	5
Constructive feedback	1	2	3	4	5
Stimulating co-workers	1	2	3	4	5
Adequate resources - Information	1	2	3	4	5
- Time	1	2	3	4	5
- Funds	1	2	3	4	5
- Facilities (s/w, h/w, databases, electronic networking)	1	2	3	4	5

7. To what extent did you encounter the following during the project?

(Prop 4)
(The question ascertains how enabling conditions contributed to the project outcome, in terms of availability/absence of constraints)

	Very Low	Low	Medium	High	Very High
Lack of motivation	1	2	3	4	5
Frequent diversions/interruptions	1	2	3	4	5
Lack of control	1	2	3	4	5
Excessive workload	1	2	3	4	5
Formalisation of processes (bureaucracy)	1	2	3	4	5
Organisational resistance and inertia	1	2	3	4	5

8. To what extent do you experience the following in the performance of your work?

(Prop 3b)
(The question ascertains the intrinsic motivation and personal orientation of project members).

	Very Low	Low	Medium	High	Very High
Challenging work/intellectual stimulation	1	2	3	4	5
Deep interest and personal satisfaction in the work/meaningful work	1	2	3	4	5
Involvement in the work	1	2	3	4	5
A feeling of accomplishment	1	2	3	4	5
High influence in what happens in the project	1	2	3	4	5
The need to attain the goals set	1	2	3	4	5
The desire to attain rewards (i.e. bonuses, increase in company share value, etc.)	1	2	3	4	5
The need for originality	1	2	3	4	5
Gaining organisational acceptance	1	2	3	4	5
Readiness to entertain new ideas	1	2	3	4	5
Independence of judgement	1	2	3	4	5

9. To what extent did the following factors influence your ability to be creative and generate potential solutions during the project?

(Prop 3C)
(The question investigates how organisational expectations and task novelty affect individual creativity)

	Very Low	Low	Medium	High	Very High
Familiarity of problems or circumstances	1	2	3	4	5
Unusual or novel situations	1	2	3	4	5
When an intelligent approach to problem-solving was valued and expected of you	1	2	3	4	5
When a spirit of co-operation was available	1	2	3	4	5
When there was job complexity	1	2	3	4	5
When there was collaboration in the project team	1	2	3	4	5

10. How is success rewarded in your company?

(Prop 4)
(The question explores the availability of rewards as an enabling condition for extrinsic motivation of individuals)

	Never	Rarely	Some times	Very Often	Always
It is just expected	1	2	3	4	5
Recognition	1	2	3	4	5
Project milestones/completion celebrations	1	2	3	4	5
Project-based profit sharing	1	2	3	4	5
Stock or stock options (i.e. future benefits)	1	2	3	4	5
Non-financial rewards	1	2	3	4	5
Other rewards (please specify)	1	2	3	4	5

11. To what extent are the following organisational characteristics present in your company?

(Prop 5)
(The question investigates the extent of the organisational orientation and the presence of situational factors that influence innovative performance).

	Very Low	Low	Medium	High	Very High
Recognition and reward of superior performance	1	2	3	4	5
A value placed on innovativeness	1	2	3	4	5
A sense of pride in the organisation's members	1	2	3	4	5
Flexible structures and procedures	1	2	3	4	5
Good communication and information flows	1	2	3	4	5
Multidisciplinary nature of the team	1	2	3	4	5
A formal innovation approach by the company, linking new ideas to specific business goals or issues	1	2	3	4	5

12. What are the major benefits to your company of the external collaborative partnerships in the project? Please rank (1=highest, 10=lowest)

(Prop 6)
(The question investigates the extent of influence of collaborative business intelligence on innovative performance).

	Ranking
Resource pooling	
Risk sharing	
Reducing supply chain uncertainty	
Long-term exchange of know-how, skills and expertise	
Variety of perspectives and ideas for the innovative product/service	
Access to technological advancements	
Broadening the product/service offered	
Generation and protection of intellectual property	
Project management	
Compatibility of company culture	

13. What are the major benefits to your company of the close partnership with the customers? Please rank (1=highest, 10=lowest)

(Prop 6)
(The question investigates the importance of external business intelligence gained as a result of collaborative relationships with customers).

	Ranking
Enabled recognition of unique needs and preferences	
Provided intelligence into the customers' unmet needs	
New insights enabled the project to be more customer oriented	
Increased customer satisfaction	
Enhanced reputation of the organisation	
Reduced effect of the competitors' efforts	
Customer loyalty	
Potential for repeat business with the same customer or similar customers	
Minimisation of potential disputes	
Enabled identification of events that could generate repeat/future business	

14. How long have you worked in the industry and in this company?

(Prop P2)
(The question investigates the extent of the collective organisational intelligence in terms of the shared team experience of the project members).

	Number of years
In the Health Care sector	
In the company	

15. Where does your experience primarily lie? Please tick.

(Prop P1)
(The question investigates the domain specific knowledge).

Experience/Expertise	
Legal	
Business development	
Health-Care service development	
Finance	
Marketing	
Design	
Other	

16. Please give a brief overview of the nature of your involvement in the project

(Prop P1)
(The question further explores the domain specific knowledge as well as the ability of the person to influence the formal and informal systems of the company to aid innovation).

17. Please give an example of a novel and useful idea/process/procedure that you applied in the project
(Prop 3)
(The question explores the creative activities carried out by the project's members that led to innovative performance).

18. In your opinion, what did the company do differently from your competitors?

(Props P1 and P2)
(The question explores the company's innovative efforts, value creation, competitive advantage and core competencies)

19. What special skills and knowledge were needed to provide the innovative service?

(Props P1 and P2)
(The question explores core competencies)

20. Were there instances, a) when the project team could apply previous experience and learning to a situation and b) when previous experience and learning led to the wrong (one size fits all) decision being taken?

(Prop 2)
(The question explores the company's accumulated knowledge and skills – organisational intelligence and core rigidities)

21. With hindsight, are there any aspects of the projects that you would have tackled differently?

(Prop2)
(The question explores how lessons learned contribute to organisational intelligence)

22. What in your opinion makes collaborative partnerships successful?

(Prop P6)
(The question explores collaborative business intelligence)

23. What in your opinion are the major risk factors in the collaborative partnerships and how do you contain those risks?

(Prop P6)
(The question explores collaborative business intelligence)

Thank you for your co-operation.

Appendix B: Analysis Data
Case Study One - ConsultCo

This section presents the analysis data for case study One – ConsultCo.

1. **Specific Expertise of Project Team**

Experience/Expertise	No. of people with expertise
Legal	2
Business development	4
Health-Care service development	4
Finance	5
Marketing	1
Design	1
NHS Strategy Consultancy	2
Business Administration	1

2. **Number of Years in the Industry and in This Company**

	Av. Number of years
In the Health Care sector	12
In the company	6

3. **Analysis Data on Individual Key Project Member**

The Key Project Team	Job Title	Age Years	Industry Experience Years	Company Experience Years
CH	Chairman	60	12	15
OD	Operations Director	50	2	2
SDD	Strategy Development Director	40	20	4
FD	Finance Director	50	10	10
DSM	Development Support Manager (NHS Strategy Consultant)	55	15	3
BDM	Business Development Manager	40	20	3.5
MM	Marketing Manager	30	5	5
AM	Administration Manager	50	13	9
	Average ÷ 8	46.9	12	6

Appendix C: Analysis Data
Case Study Two - ResearchCo

This section presents the analysis data for case study Two – ResearchCo.

1. Specific Expertise of Project Team

Experience/Expertise	No. of people with expertise
Audio Technology	3
Multimedia	3
Design	2
Business Development	2
Marketing	1
Legal/Patent	1
Finance	0

2. Number of Years in the Industry and in This Company

	Av. Number of years
In the R & D sector	14
In the company	13
In the project	9

3. Analysis Data on Individual Key Project Member

The Key Project Team	Job Title	Age Years	Industry Experience Years	Company Experience Years	Project Experience Years
MD	Managing Director	48	15	15	10
CD	Commercial Director	55	10	6	6
OD	Operations Director	36	10	10	8
CS	Chief Scientist	48	20	20	12
CRM	Customer Relations Manager	40	15	14	10
	Average ÷ 5	45.4	14	13	9

Appendix D: Requirements Specification for the Hospital Development

This section presents the customer's requirements specification for the 'Main entrance/Reception – 2000 and beyond', that was used in the project in Case Study One.

General principles

The main entrance/reception,

- Offers a gateway to hospital services;
- Projects a positive corporate image within a comfortable, modern first-class environment;
- Provides a central focus for visitors to and users of hospital services;
- Supports the operational function of hospital activities;
- Facilitates the patient flow in outpatients and provides sufficient circulation space;
- Minimises congestion;
- Incorporates flexibility to accommodate changes in demand and usage over the next two decades.

Assumptions

- The re-designed main entrance will be usable for 25 years
- All visitors and non-emergency patients are expected to use the main entrance
- Equivalent space will be re-provided elsewhere for displaced services/offices
- Interests of the commercial element of the scheme will be addressed

Existing services

Reception-Enquiries	✓	Porters room	x
Telephones	✓	Post room	x
Wheelchairs	✓	Dispatchers' office	x
Ambulance pick-up	✓	Supervisors' office	x
Convenience store	✓	Clinical coding office	x
Outpatient waiting area	✓	Ambulance liaison	x
Outpatient reception	✓	Anti-coagulant clinic	x
Charity stalls	✓	Health records manager office	x
Toilets	✓	Senior medical common room	x
Post box	✓		

> ✓ - Services still required in main lobby area
> X – Services not essential in lobby area

New facilities required

Information point	Main enquiry desk
Information resource	Central space for patient information/leaflets
Outpatient check-in	Dedicated point for check-in only
Outpatient check-out	Check out point near to OPD
Play area	A children friendly area
'Quiet' or 'reflective' area	For patients/visitors following consultations
Wheelchair depot	Discrete collection/parking point
Mobile phone/email area	For patients and visitors
Interactive help points	Touch screen maps? Self-service check-in?
Communication systems	Screens/Tanoy public address system

Issues/objectives

- Traffic management outside the main entrance

- Drop-off points, pick-up points and a way of enabling patients to go straight to outpatients

- Disability discrimination requirements

- Security requirements

- Good/clear signage

- The hospital's continuing relationships with the existing service providers such as the convenient store and the staff shop.

- Minimal future commercial risk for the Trust.

Examples of additional information gathered by the project team regarding requirements

The hospital currently has employee numbers in the region of 3,200 and this should substantially increase over the next three to four years as a result of other new developments on site.

Once completed the main reception will double as the Outpatients reception and unlike many other hospitals, all of the outpatient, visitor and staff activity will be concentrated in this area.

The vast majority of patients, visitors and staff coming to the hospital will access through the main reception concourse onto the main street or into the Outpatients department and will therefore spend time in and around the reception area.

Patient statistics for the hospital for the year 1999/2000:

Outpatient attendance – 222,200

Patients attending for blood samples to be taken in Outpatients – 22,000

Patients attending physiotherapy department – 16,350

Day unit patients – 17,000

Accident and emergency attendance – 75,000

The Trust expects that activity and therefore the number of patients, visitors and staff coming to the hospital will increase in the coming years.

The development of primary-care groups means that the Trust will concentrate on acute health care based at this hospital site, as it is the major acute hospital in the region.

The Trust is also planning a new clinical building adjacent to the main reception area, which will accommodate an integrated eye department with outpatients, diagnostic facilities and operating theatres.

As the population ages and the number of people over 75 increases, the activity within this new clinical building is set to rise year on year.

There is also a medical school within the hospital, which would contribute to the figures already provided above for visitor numbers to the retail elements of the main entrance.

The NHS national plan sets very specific targets for health trusts in respect of reducing waiting times. This means that the number of investigation and diagnostic tests carried out on patients will increase year on year therefore creating a general increase in activity within the hospital.