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Knowledge Management in South African Project-Based Firms

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Knowledge Management in South African Project-Based Firms

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration.

Johannesburg, 2012

ABSTRACT

Knowledge management is a key source of innovation in organisations. Knowledge acquired from dealing with one client can be recycled through a process of knowledge transfer and storage to improve innovation and to affect the performance of organisations. In our information economy, producing and distributing information and knowledge are a major source of wealth and prosperity. In this context, it becomes important for organizations to manage their knowledge as a key strategic resource with particular reference to the nature of the operations of the firm.

The main problem is to evaluate how project based firms source knowledge from projects, how they optimize their knowledge resources and how they meet challenges in project knowledge management in South Africa.

This research is qualitative in nature and the type of research is an interpretive study. Based on a literature review, a semi-structured interview was conducted and the data collected was codified, categorised and compared with the literature review to confirm the key findings.

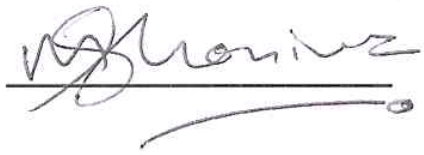
The key findings of this research were aligned to each part of the main research problem as follows.

- Project based firms can source their project knowledge through dialogue, using web portals, organisational culture, fostering sociable environments, building relationships and choosing diversified knowledge workers.
- Project based firms can optimise their knowledge assets for projects through bundling knowledge into transferable packages, strict policing of document standardisation, using classification, tags and codes, exposing and acknowledging knowledge workers, protocols and standardising information systems.
- Project based firms can meet the challenges of managing project knowledge through strict protocols, using professional external facilitators for project audits, creating conducive environments for sharing mistakes and keeping a centralised knowledge repository and team member directory.

The key message is that the principles of knowledge management which have been applied in businesses and organisations can also be applied to project based firms with great effect and profitability.

DECLARATION

I, Martin Shoniwa, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Martin Shoniwa

Signed at Johannesburg

On the 24th day of October 2012

DEDICATION

This research is dedicated to my late father. You were my best friend ever and my number one fan. You always believed I could go all they way. This is just the beginning. Thank you for believeing in me.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to the following people for their contribution to this research.

- Mr Trevor Lake for his commitment and support towards me as supervisor during this long and challenging process.
- All the participants in my research for their generosity, meaningful contribution and honesty.
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1. INTRODUCTION

1.1. Purpose of the study

The purpose of this study is to evaluate how knowledge management systems are used project-based firms (PBFs). The study will focus on identifying the critical success factors of knowledge management in PBFs in view of the unique problem-solving, unpredictable and time-delimited nature of projects (Ajmal, Kekale and Takala, 2009). Finally, the report will establish a framework that optimises the components of knowledge management specifically for implementation in PBFs.

1.2. Context of the study

Knowledge management has long been recognized as a key source of innovation (Taminiau Smit and de Lange, 2009) and performance (Darroch, 2005) in organizations. Donate and Guadamillas (2010) reinforce this by stating that knowledge acquired from dealing with one client that has been recycled through knowledge storage and transfer produces a positive and significant effect on innovation in organizations. Furthermore, Laudon and Laudon (2010) identify that without knowledge, firms become less efficient and less effective in maximizing their other resources and eventually fail. Therefore, knowledge management is a critical component in optimizing the performance and innovation in organizations, and not investing in knowledge can result in organizations failing.

As a result of its critical importance, knowledge management has been identified as a key economic and intangible resource that leads to increasing returns and higher leverage that can be turned into value that impacts the bottom line in organisations (Smedlund, 2008). According to Walker and Christenson (2005), knowledge management and knowledge networks not only contribute to building a competitive advantage and improving an organization's service delivery, but they also build organizational memory as a valuable knowledge asset and business strategy. That is why Laudon and Laudon (2010) acknowledge that in our information economy, producing and distributing information and knowledge are a major source of wealth and prosperity. So investing in knowledge management as a strategic resource can benefit an organization both in terms of financial returns and in building a long-term intangible valuable organization's asset.

Having identified knowledge management as a key strategic resource that companies can invest in, it is important to understand the kind of asset that knowledge management is so as to maximise its potential benefits. Cavusgil, Calantone and Zhao (2003) recognize that knowledge is unique and inimitable, which implies that investing in knowledge must be specific and customized to an individual organization's characteristics. Laudon and Laudon (2010) further acknowledge that knowledge is a

different kind of asset from buildings and financial assets and Spender, 1996 (cited in Cavusgil, Calantone and Zhao, 2003) asserts that the importance of knowledge assets far exceeds any other physical and financial assets in organizations. Laudon and Laudon (2010) further state that managing knowledge effectively is 20% technology and 80% organizational. Given the difference in processes between project-orientated and operations-orientated firms (Project Management Institute 2004, 6), it becomes clear that unique, customized investments in knowledge assets need to be made by PBF, which are different from Operations Based Firms. Literature has extensively covered implementing knowledge management in OBF (Delen and Al-Hawamdeh, 2009; Kokavcova and Mala 2009; Rubenstein-Montano et al 2001; Walker and Christenson 2005), but there is need for literature to expand on how knowledge management implementation can be optimized for PBF.

1.3. Problem statement

1.3.1. Main problem

The main problem is to evaluate how project-based firms source knowledge from projects, how they optimize their knowledge resources and how they meet challenges in project knowledge management in South Africa.

1.3.2. Sub-problem 1

The first sub-problem is to analyze how South African project based firms source knowledge from projects they undertake.

1.3.3. Sub-problem 2

The second sub-problem is to analyze how South African project based firms optimize their knowledge resources in projects they undertake.

1.3.4. Sub-problem 3

The third sub-problem is to evaluate the challenges that South African project based firms face in managing project knowledge.

1.4. Significance of the study

Dunford (2000, cited in Taminiau Smit and de Lange, 2009) predicts that firms are more likely to compete for knowledge resources rather than land ownership and access to capital. Kokavkova and Mala (2010) also identify knowledge as one of the most powerful and important asset in an organisation, which ultimately determines its future success but they concur that nobody knows how

to manage it. Furthermore, Penrose (1959, pg. 25 cited in Darroch 2005) states, “the way in which knowledge is managed and used will affect the quality of services that can be leveraged from each resource owned by the firm.” Teece (2001, p. 128 cited in Gammelgaard and Ritter, 2005) notes, “knowledge, which is trapped inside the minds of key employees, in filing drawers and databases, is of little value if it is not supplied to the right people at the right time” and Gammelgaard and Ritter (2005) note how firms have intensified their efforts to make knowledge available across the organization so as to allow a tremendous amount of information to be available to the individual. Therefore, while the importance and benefits of organizations building knowledge assets are clear, the real value of knowledge lies in managing these assets and making adequate knowledge available to workers at the right time. Knowledge is only useful if it can be managed and accessed effectively.

This study fills a gap in making knowledge assets more manageable and accessible for PBF. A lot of literature extensively covers how knowledge is accessed, codified and managed in an Operations Based Firms (Hall, 2006; Taminiau Smit and de Lange, 2009; Schulz and Jobe, 2000; Ajmal, Kekale and Takala, 2009) but very little literature exclusively focuses on the codification of knowledge in a project environment.

The organizational structure of projects and project teams is decentralized and the knowledge is mostly fragmented (Disterer, 2002) and this results in project team members being spread all over different companies and project documentation being stored without retaining the essentials for later use. Disterer also identifies another consequence of not managing project knowledge to be the possible repetition of decisions and actions that caused problems and errors in previous projects. He proceeds to note that experiences of working together remain hidden in the heads of some project team members and are not identified, evaluated, and disseminated in a systematic way and such knowledge risks getting lost with the end of a project. This research fills a gap by facilitating a framework and proposing methodologies to structure and centralize project knowledge so as to continuously apply from past projects’ experiences to assist in addressing current project problems and challenges.

The main challenge in building knowledge assets for PBF is that projects by their nature are unique so it is difficult to create knowledge that can be reused and therefore PBF are forced to create new solutions to every problem, which is clearly inefficient (Ajmal, Kekale and Takala, 2009). The above authors proceed to note the key characteristics of a PBF to be “significant interdependence among different kinds of knowledge and skills; complex and unpredictable tasks and problems; and time-delimited project goals”. However, Ajmal, Kekale and Takala (2009) are quick to point out that even if the details of projects are unique, the essential processes involved are usually similar therefore most projects do not require a PBF to start from scratch but they can utilize existing processes and knowledge acquired from previous projects. This study fills a gap in identifying techniques and best

practices in developing project templates and structures to standardize essential processes in projects, which define structures for project knowledge to be reposited.

Disterer (2002) identifies that the documentation of projects is not specifically designed for reuse in future projects because it does not contain methods and proceedings, doesn't outline precise problems, doesn't describe successful and unsuccessful solutions, doesn't mention persons to tum to and external experts, doesn't contain descriptions of successful cooperation and their success factors and doesn't describe "lessons learned" to help in future projects. Therefore, there is a need for project-based documentation to be produced in a way that it can easily be translated into a resource for future projects. This study will give guidance to how knowledge management can provide project documentation templates that are refined with each project to become a valuable knowledge resource for the company's future projects.

Ajmal, Kekale and Takala (2009) identify that the temporary nature of projects means that they do not possess any "organizational memory" in themselves and hence do not possess any natural knowledge-transfer mechanism in contrast to operations, which have a definite structure and established routines that enable them to absorb and retain knowledge, and so they propose deliberate management initiatives to create, capture, and transfer such knowledge. This study will provide a framework for knowledge discovery, creation and transfer in a project-based environment.

Disterer (2002) identifies that once a project is finished, there is usually no repository left where existing knowledge can be stored and accessed, especially documentation on the lessons learnt. He recognizes that capturing knowledge and experiences in projects are usually dropped because of missing time resources, the main reason being that members of the project team are needed for other following projects and their new team leaders will "pull" to get them into the teams as soon as possible. This study will provide guidance in how a project-based environment can build a repository for a PBF to discover, create, store and manage as the projects are implemented so as to prevent cancellation of knowledge capture at the end of the project where knowledge capture is most critical.

1.5. Delimitations of the study

This research will focus on the knowledge management related behaviour and practices of project managers in project based firms only. The study will not address the different routines and processes of organisations, which vary with the diverse nature and characteristics of industries that implement a project-based approach to their business operations. Industry specific operational processes and routines are beyond the scope of this research.

The research will address principles of knowledge management as implemented in projects with the objective of formulating a framework for building knowledge assets in a project-based environment. The study will not interrogate knowledge management using any project management frameworks like the Project Management Body of Knowledge (PMBOK) or Projects in Controlled Environments (PRINCE). While the above mentioned project management frameworks are useful in implementing projects, it is intended that the implementing project-based knowledge management must be universal and flexible regardless of which project management framework is used.

While most of the knowledge workers of project based firms interviewed and surveyed in this research are rooted in the architectural, engineering and construction industries, this study is intended to address project-based knowledge management in diverse industries and market sectors. As a result, project managers from industries as diverse as computer software engineering and business process engineering have also been interviewed and surveyed.

This study will be narrowed to surveying and interviewing only veteran project managers with at least five years experience in project-based firms whose experience spans different cities, provinces and countries.

1.6. Definition of terms

Project Based Firms (PBF): Ajmal, Kekale and Takala (2009) define project-based firms as “commercial entities that organize their activities around numerous self-contained projects that can be treated as separate organizational entities”. Project-based firms “give privilege to the project dimension and carry out most of their activities in projects” Lindkvist (2004, pg. 5 cited in Liang and Huvanandana, 2008).

“Knowledge Management (KM) is a directed process of figuring out what information a company has that could benefit others in the company (or shared with business partners), then devising ways of making it easily available. Put simply, KM is defined as "we don't know what we know." Knowledge suitable for managing in a company includes: Skills and knowledge that a company has developed about how to make its goods or services. Individual employees or groups of employees whose knowledge is deemed critical to a company's continued success; and a company's aggregation of documents about processes, customers, research results, and other information that might have value for a competitor (and which is not common knowledge.)” – (Bradford 2008, 213)

“Knowledge workers, include researchers, designers, architects, scientists, and engineers who primarily create knowledge and information for the organization. Knowledge workers usually have high levels of education and memberships in professional organizations and are often asked to exercise independent judgment as a routine aspect of their work.” – (Laudon and Laudon 2010, 452)

“Knowledge assets represent the databases, books, information allocated in and around an organization.” – (Kokavcova and Mala, 2009)

“Organizational and management capital is the set of business processes, culture, and behavior required to obtain value from investments in information systems.”– (Laudon and Laudon, 2010)

1.7. Assumptions

This study assumes that knowledge is embedded in data and that there is a continuous and linear flow between data, information and knowledge. This is a reasonable assumption because information can simply be viewed as patterned data and knowledge is the capacity to act on information (Leibowitz, 2001). Therefore knowledge is built on information, which in turn is built on data. Lack of continuous linear flow from data to knowledge will severely affect the validity of this study.

This study also assumes that the factors to be emphasised in creating and discovering knowledge, transferring knowledge and building knowledge repositories are similar across all industries and market sectors of project-based firms. This is a reasonable assumption because Bradford (2008) states that organisations that benefit most from knowledge management are those that have identified and emphasised the most important success factors. Furthermore, Laudon and Laudon (2010) state that companies get the most value from transforming process, culture and behaviour into organisational capital. This implies that there are certain common factors that need to be amplified to successfully implement knowledge management. Inconsistent success factors for implementing knowledge management across PBFs in this study would result in lack of credibility.

The study also assumes that the strategic goals and objectives of investing in knowledge management are similar and well understood by PBFs, which results in a common measure and definition of a successful implementation. This is a reasonable assumption because anunderstanding how the benefits and value of knowledge management implementation should fundamentally align with achieving corporate objectives (Bradford, 2008) and they must form a compulsory part of the knowledge audit, strategy and policymaking embedded in implementation (Ray, 2008). Misunderstanding of common knowledge management implementation objectives by PBFs result in this study lacking credibility because the parameters defining success are inconsistent.

2. LITERATURE REVIEW

2.1. Introduction.

This literature review addresses the implementation of knowledge management systems in project based firms by developing a framework based on the definition of the essential terms in the research topic. Since this research primarily addresses project-based firms, the background discussion in Heading 2.2 extensively reviews literature on the characteristics and critical success factors of knowledge management implementation benefits in the specific context of project environments with specific references to challenges, which need to be addressed.The objective is to assess the benefits of the efficient and effective knowledge management implementation to project-based firms.

The Collins English Dictionary (2010) defines “implement” as both a noun - “an equipment, tool, or utensil … used to achieve a purpose” and a verb – “to carry out; put into action; perform”. This implies that implementation is both a tool or body of knowledge and a methodology with recommended best practices. So this review is going to critically assess literature on the implementation “tools” and body of knowledge on knowledge management and then the best practice “methodologies” in implementing knowledge management.

The Collins English Dictionary (2010) also defines a “system” as a “group or combination of interrelated, interdependent, or interacting elements forming a collective entity; a methodical or coordinated assemblage of parts, facts, concepts.” This implies three critical components to a system; structure, behavior and interconnectivity. Therefore the literature on tools and methodologies of knowledge management systems is going to be critically reviewed in the framework of systems components; for its structural, behavioral and networking capabilities.

2.2. Sourcing Knowledge from Projects

2.2.1. Knowledge Networks and Communities of Practice

2.2.1.1 Knowledge Networks

Knowledge networks provide the link between people and knowledge (Walker and Christenson, 2005). According to Laudon and Laudon (2010), knowledge networks address the problem of appropriate knowledge not being in the form of a digital document but instead residing in the memory of expert individuals. The authors describe knowledge networks as an online directory of subject matter experts, which includes the communications technology to contact the relevant expert and the databases to systematically capture solutions developed by experts as best practices or frequently asked questions. The authors finally give examples of knowledge networks including blogs, wikis and

social book markings to help capture, consolidate and centralize knowledge and to capture collaboration and information exchange.

Early English dictionaries said that one type of knowledge is what is known about a subject and the other type is knowing where to find information about the subject (Oz and Jones 2006). The focus of a knowledge network is how to retrieve knowledge from organisational memory through searching and decoding process into a format that is relevant to a particular problem or goal (Gammelgaard and Ritter 2005). To achieve this, organisational knowledge within a firm must be interconnected through hyperlinks to create a KM infrastructure, the expertise embedded within employees must be recorded, and focus must be emphasised on integration points to ensure the system is centrally manageable (Ray, 2008).

According to Oz and Jones (2006), the advantage of building knowledge networks that focus on directing employees to other employees who have certain expertise over building knowledge networks that access a database is that an expert can provide information that has not been captured in information systems. They proceed to describe how intranets use web technologies to link employees of the same organisation by processing their emails and documents to discover each employee's work focus, expertise and business relationships. The intranet then builds a knowledge base of employees' profile of focus topics and interests through which a search engine will identify that person as a subject matter expert and their contact details will be provided should another expert search for that topic.

The effectiveness of knowledge networks is best understood when organisations recognise that almost half of the work that knowledge workers do in organisations, like researching a subject, preparing a report and providing information, has already been done and labour worth up to 3600 Euro per knowledge worker is wasted annually because workers are trying to solve the same problems that other workers have already solved (Oz and Jones, 2006). Another effect of a knowledge network is its capacity to prune information before storing it in the organisation's repository to avoid information overload because having more information does not necessarily mean having more knowledge (Ray 2008). Knowledge networks are also effective in accumulation of best practices and methods and tools that will lead to new innovative ideas (Werr and Stjernberg, 2003 cited in Taminiau Smit and de Lange, 2009). Ray (2008) highlights that a final major effect of knowledge networks is that lessons learned and recorder are invaluable when trying to avoid making the same mistake twice.

2.2.1.2. Communities of Practice

A community of practice (CoP) is defined as a group of individuals who share knowledge, learn together and create common practices (Wenger, 1999 and McDermont, 1999 both cited in Zarraga-

Orbety and De Saa-Preez, 2006). Zarraga-Orbety and De Saa-Preez (2006) proceed to differentiate a CoP from a team, from a workforce, and from an authorized group by the fact that a CoP is bounded together by the need to know what each of the others in the community know. Retna and Ng (2011) emphasize that a CoP is a set of relationships that evolve over time through which community members are able to hear and exchange useful tips that are not located in any physical archive.

CoPs operate with informal goals, a common language, shared understandings and reasonable levels of trust and become very efficient in transferring tacit and complex knowledge among their participants (Gammelgaard and Ritter, 2005) Communities of practice do not normally need complex organizational structures but their members need time and space to collaborate (Zarraga-Orbety and De Saa-Preez, 2006). The essence of learning in a CoP is rooted in that rather than being sourced from books, learning for most people is a process that takes place among and through other people and therefore knowledge is a property of relationships (Retna and Ng 2011).

Laudon and Laudon (2010) point out that CoPs greatly depend on software environments that can facilitate group education, conferences, online newsletters, day-to-day sharing of experiences and problem solving techniques to enable collaboration and communication. The above authors proceed to identify how members of CoPs benefit from reuse of knowledge by directing members to useful documents, creating document repositories, and filtering information for newcomers, reducing the learning curve for new employees by providing contacts with subject matter experts and access to a community's established methods and tools, and finally acting as a spawning ground for new ideas, techniques, and decision making behavior. Retna and Ng (2011) further complement CoPs for being effective in handling unstructured problems, for sharing knowledge outside of the traditional structural boundaries, for developing and maintaining long-term organizational memory, and for greatly improving response time when handling customer problems.

2.2.2. Organisational Culture

Organisational culture is a set of rules, values and beliefs shared by a firm’s members to condition their behaviour and to also configure the firm’s image and identity in relation to its environment (Donate and Guadamillas, 2010). Organisational culture plays a critical part in the success of any knowledge management system through fostering the sharing, learning and creation of knowledge to produce information that can transform a business (Ray, 2008). In fact, Rubenstein-Montano, et al, (2001) identify people and culture as the driving factors that determine the success or failure of knowledge management initiatives. According to Leibowitz (2001), building a supportive culture for knowledge management is 90% of the effort and this must not be overlooked to focus on information systems and technology. Culture constitutes a general framework in which a company’s knowledge management strategy is established (Earl, 2001 cited in Donate and Guadamillas, 2010). Therefore, it can be stated that organisational culture critically affects the success of implementing knowledge

management systems and not investing in organisational culture can lead to knowledge management implementation failure.

Donate and Guadamillas (2010) describe how culture contributes to the success of knowledge management because of its important role in establishing a firm's strategic framework and its influence on other organisational aspects such as structure, management style and human resources management. They argue that promoting company culture should make implementation of KM easier because it is embedded in values, beliefs and company work systems and this should contribute to establishing a shared organisational vision in terms of launching effective KM practices. The authors finally identify the main challenge to be for organisations to establish what specific values should be developed and how they should be adjusted to the KM practices implemented by the firm.

Chen, Huang and Hsiao (2010) further argue that organisational culture and climate has great impact on work environment and this in turn affects employees' behaviour and relationships that encourages or inhibits the sharing of knowledge. They propose a work environment that is sociable, encouraging, open, relationship orientated and collaborative so as to send a clear message to employees that they are expected to openly exchange information and therefore create and share knowledge. Kokavcova and Mala (2009) enhance this argument by describing a shared space for interaction that can be physical, virtual or mental where embedded knowledge is acquired through individuals' experience or reflections on others' experience.They argue that organisations become more effective and competitive by striving to create such a space to support learning from past experiences and to develop knowledge gained. The authors hence conclude that this space becomes the main aspect of an organisational knowledge-sharing culture which supports knowledge creation and transformation processes

2.2.3. Social Capital, Firm Interactions and Collaboration

2.2.3.1. Social Capital

Social capital can be defined as the value of an individual's relationships with other individuals in helping to get things done in a firm, or the sum of actual and potential resources from the network of relationships possessed by an individual or a social unit (McElroy, 2002 and Nahapiet and Ghoshal, 1998 both cited in Gammelgaard and Ritter, 2005). According to Walker and Christenson (2005), social capital structurally comprises of network ties, network configurations and appropriate organization for these networks. According to Smedlund (2008), social networks are the most important source of social capital, because social capital is understood as being found in the connections between and among individual people.

Adler and Kwon (2002, cited in Smedlund, 2008) have notions of the capital metaphor in social capital that are very useful in understanding its effect on knowledge management. They acknowledge how social capital can be converted into other kinds of capital and how it can substitute or complement other resources. They also identify how social capital needs maintenance unlike financial capital and how it does not have a predictable rate of depreciation unlike physical capital. Finally they identify that social capital is not located in the actors but in relationships between actors and therefore it has to function as a mechanism turning raw material into a finished product. The authors conclude their metaphor of social capital's effect on knowledge by arguing that social capital produces economic wealth, as well as producing more of itself.

Mu, Peng and Love (2008) have identified that by leveraging social capital, firms can gain access to knowledge that is embedded in inter-firm relationships and firms can also leverage social capital to gain competitive advantage. They further argue that social capital can improve the operational efficiency of firms and enhance knowledge flow as a mutual, continual and iterative process. They further suggest that social capital improves the openness between partners and this in turn encourages interaction and coordination at reduced costs, which results in channeling and sharing knowledge between firms.

2.3.3.2. Firm Interactions and Collaboration

Cavusgil, Calantone and Zhao (2003) highlight how a high degree of knowledge can be obtained through close interactions with partner firms. They emphasize close relationships between firms as being necessary for knowledge transfer because strong ties promote in-depth communication and enhance opportunities for people to share feelings, emotions, collaborative experiences and mental models which results in inter-firm transfer of knowledge. They further argue that experience in collaboration with other firms enables an organization to be more effective and efficient in the transfer of knowledge and developing close relationships with other firms plays an important role in obtaining knowledge and understanding processes. Darroch (2005) enhances this argument by stating that responsive organizations are likely to extract more from their resources and therefore enjoy more superior benefits than less responsive organizations.

Mu, Peng and Love (2008) also argue that the most efficient way for firms to absorb and acquire knowledge was through direct communication with their partners. They express how firm performance, in terms of profit, sales volume, and innovation, greatly improve through networking with their partners and how relationships that firms build play a large role in helping them to secure key resources and information that are difficult-to-acquire. They describe how inter-firm relationships have helped firms acquire large amounts of useful and valuable knowledge and have hence helped the firm to recombine current stock of knowledge and create new knowledge. Dyer and Singh (1998, cited in

Walker and Christenson 2005) further argue that supernormal profits are generated from inter-firm knowledge routines and complementary resource endowments.

Zarraga-Orbety and De Saa-Preez (2006) recommend that firms should collaborate with firms and individuals who have different and complementary skills so that everyone can apply different structures and mental models that produce multifaceted dialog. They also propose that interactions between individuals with different and diverse knowledge structures will increase the organizational capability for creating knowledge. They further encourage people to have a common language and common understanding of what they are doing.

2.2.4. Research Proposition

Project based firms source their knowledge using

- Knowledge Networks, Communities of Practice,
- Organizational Culture
- Social Networks, Inter-firm Networks and Collaboration

2.3. Optimizing Project Knowledge Resources

2.3.1. Codification, Knowledge Transfer and Knowledge Sharing

2.3.1.1. Codification

Cowan and Foray (1997 cited in Hall 2006) define knowledge codification as the process of conversion of knowledge into messages, which can then be processed as information. According to Schulz and Jobe (2000), codification contributes to knowledge management effectiveness through packaging knowledge into formats that facilitate knowledge transfer and flow. Hall (2006) further emphasises the idea that knowledge needs to be moved around or transferred within organisations as a fundamental precept of knowledge management and Davenport and Prusak (1998, cited in Hall, 2006), view codification as the primary vehicle by which knowledge becomes ‘‘portable,’’ ‘‘re-usable’’ or ‘‘transferable’’ within the organization.

According to Paswan and Wittman (2009), many organizations gather a variety of information and simply put it in libraries and this information is never used to enhance a company’s competitive position, to improve their products, or to serve their customers. The above authors emphasize managing knowledge as a key to success of business systems like franchises because successful franchisors do not sell products and services but they perfect a business system and sell the know-how and benefits of the business system to franchisees and subsequently to customers. Schulz and Jobe (2000) enhance this argument by defining firms as codification machines that derive most of their competitive advantage from codifying tacit knowledge. This implies that codification is effective in

transferring knowledge into a useful organizational processes and this in turn can potentially improve the organization's products and services.

According to Taminiau Smit and de Lange (2009), methods and tools are a source of codified knowledge because they provide guidelines and standards on how to execute projects. They also identify cases stored in organizational databases as codified previous projects that can be used as starting points for projects. However, the authors note the challenge of how to generalize specific cases so they can be usable in more general organizational projects and they suggest a process called contextualizing which involves writing a short report on the context in which the knowledge was generated and to which ends it can and cannot be used. Schulz and Jobe (2000) proceed to outline ways in which codification can be accomplished, including encoding of organizational knowledge in formulas, codes, expert systems, "spec sheets." or budget information; expressing knowledge in natural language formats, such as reports, memos, or policies; embedding knowledge in physical objects, such as prototypes or technologies, or even depositing it in employees who visit or rotate between different subunits.

2.3.1.2. Knowledge Transfer

Donate and Guadamillas (2010) define knowledge transfer as the process through which a unit is influenced by the "experiences" of another unit as evidenced by the changes in the knowledge and results of the recipient unit. The above authors cite Alavi and Tiwana in stating that knowledge transfer is not carried out between organizations but rather between individuals, between individuals and repositories, and between repositories. Donate and Guadamillas (2010) further argue that the difficulty of the task of transferring knowledge from one place to another depends on the conditions and aspects that have some influence in the process.

Donate and Guadamillas (2010) also talks about knowledge transfer hand in hand with knowledge storage and implies that the two processes are inseparable. Walker and Christenson (2005) describe how the process of storing knowledge embeds the recycling and transfer process and they argue that no existing stored knowledge can ever remain untransformed because knowledge transfer has a constant re-contextualization and interpretation occurring. Donate and Guadamillas (2010) proceed to cite Alavi and Tiwana (2003) in identifying three types of activities that a firm should develop to effectively gather valuable explicit knowledge: (1) define content characteristics of the repositories; (2) establish content sources and specify the means to collect the key knowledge; and (3) develop the content of the external memory and specify the means to access the knowledge.

Donate and Guadamillas (2010) state that storage and transfer are based on the organization, structuring and dissemination of organizational knowledge in order to effectively exploit it. Adjusting

behaviour by creating by creating new business processes or by changing management decision-making patterns is called organisational learning (Laudon and Laudon, 2010). Gavin (1993, cited in Ajmal, Kekale and Takala, 2009) defined a learning organisation as one that is not only capable of creating, acquiring, and transferring knowledge, but also able to modify its behavior to replicate new knowledge and insights. Watkins and Golembiewski (1995, cited in Ajmal, Kekale and Takala, 2009) contend that a "learning organization" is able to create systems that ensure long-term capabilities to capture knowledge and thus empower continuous transformation. Ajmal, Kekale and Takala (2009) conclude that when knowledge is learned and embedded into individual and organizational processes, the value of that knowledge to the individual and organization increases significantly.

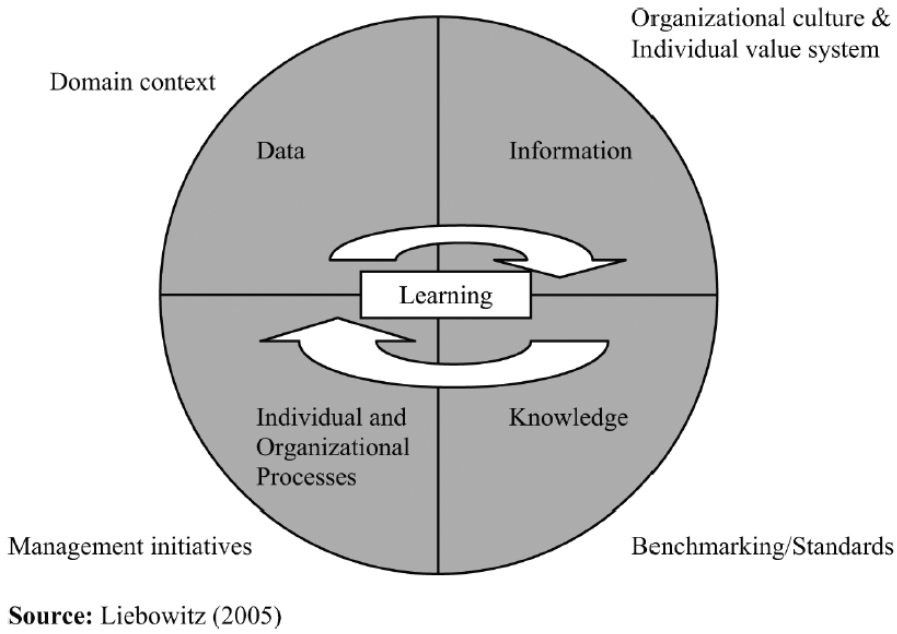


Figure 2: The Knowledge Management Model. Source: Leibowitz, 2005 cited in Ajmal, Kekale and Takala 2009

2.3.1.3. Knowledge Sharing

Lin (2007) defines knowledge sharing as a social interaction culture involving the exchange of employee knowledge, experiences and skills through an organisation. The above author explains how knowledge sharing occurs at an individual level to help colleagues do something better, quicker and more efficiently and how it occurs at an organisational level to capture, organise, reuse and transfer experience based knowledge in organisations making that knowledge available to others in the business. The above author highlights that knowledge sharing enables organisations to enhance innovation performance, reduces redundant learning efforts, and generates solutions and efficiencies that provides a business with competitive advantage.

Laudon and Laudon (2010) emphasize the close relationship between knowledge management and collaboration by emphasizing that knowledge that cannot be communicated and shared with others is useless and that knowledge only becomes useful and actionable when shared throughout the firm. Kokavcova and Mala (2009) identify knowledge sharing as a psychological issue because knowledge owners have to be ready, willing and able to offer their “intellectual property” which is usually based on long term practical experience. According to Taminiau Smit and de Lange (2009) lack of knowledge sharing implies a large financial risk because when a knowledge worker leaves the company, they take with them their ideas, skills and knowledge. They identify how the risk is multiplied if that knowledge worker starts their own company, which gains first mover advantage or joins a competing organization that can acquire his knowledge and hence emphasize the importance of some structure to retain organizational memory.

While literature acknowledges that knowledge sharing is a challenge (e.g. Kokavcova and Mala, 2009; Gupta et al, 2001 cited in Ray, 2008), there seems to be contrasting views on using incentives and rewarding systems to enable efficiency in knowledge sharing. Ajmal, Kekale and Takala (2009) identify that recognition and reward structure within an organisation must be built into the daily working routines of organisations to encourage people to take part in knowledge management activities. Leibowitz (2001) also supports an incentives or reward system to motivate knowledge sharing and Ray (2008) recommends a reward system including bonuses, percentage of company profits, peer recognition, special titles and challenging assignments. However, the hypothesis that organizational rewards positively influence employee willingness to donate and collect knowledge is not supported in research by Lin (2007).

Lin (2007) emphasizes a close link between knowledge sharing and information and communication technology (ICT) because ICT provide communication channels for obtaining knowledge, correcting flow processes, and identifying the location of knowledge carriers and requesters. He further argues that employees who feel pleasure in sharing knowledge and thus helping others tend to be more motivated to donate and collect knowledge with colleagues because they are driven by a sense of the competence and confidence. Mu, Peng and Love (2008) emphasize the importance of developing personal relationships and earning trust because strong ties in relationship networks serve as bridges for knowledge sharing. Taminiau Smit and de Lange (2009) identify processes like meetings, organized brainstorm sessions and in-house training with an emphasis on observation to be critical to effective knowledge sharing.

2.3.2. Classification and Indexing

Laudon and Laudon (2010) identify a key problem in managing knowledge as the creation of an appropriate classification scheme, or taxonomy, to organize information into meaningful categories so that it can be easily accessed. They state that once the categories for classifying knowledge have been created, each knowledge object needs to be "tagged" to its appropriate class, so that it can be

easily retrieved. Delen and Al-Hawamdeh (2009) identify the use of keywords and indexing as the most commonly used method of managing unstructured information especially on the Internet because of its benefit in identifying information. According to Rubenstein-Montano (et al 2001), 90% of all organizational data is stored in some sort of unstructured text so there is a need to process unstructured data sources.

According to Hall (2006) attempting to transfer knowledge requires the definition of codes so as to help interpret and "decodify" the knowledge. He argues that people with similar knowledge and experience interpret and use codes more similarly and that it is easier to diffuse knowledge to communities who can read the codes. He further argues that knowledge is difficult to store and transfer without any sense of the end-use context or how the information will be decodified so as to translate this knowledge into action. Hall (2006) concludes by proposing that knowledge management should start from the perspective of decodification before embarking on knowledge creation and knowledge transfer and concludes that for someone else to be able to decodify knowledge, it must be coded in a language they understand and this most likely occurs when the codifier and decodifier are the same person.

Gammelgaard and Ritter (2005) expand on this argument by noting that a sender of knowledge designs his own meaning and context to text and the receiver decodes knowledge to his own context to apply it to a specific situation and the inevitable context gap between sender and receiver can only be broken by some kind of codebook to understand the knowledge. Ajmal, Kekale and Takala (2009) note that KM is an action discipline which needs to be applied to have a measurable impact and according to Taminiau Smit and de Lange (2009), it therefore has to be translated and presented in a manner that others can understand it too and use it as well. They proceed to explain the difficulties reside in taking out the specialties of a project's knowledge and generalizing it in such a way as to be able to share the valuable knowledge obtained. Darroch (2005) further proposes viewing KM as a coordinating mechanism that enables resources to be converted into capabilities and facilitates the flowing of information through an organization. It can hence be concluded that classification and decodification of knowledge has a role of not only structuring knowledge but also dictates the processes and workflow in organizations through the management of how classified knowledge is used.

2.3.3. Knowledge Workers and Using Information Systems

2.3.3.1. Knowledge Workers

Laudon and Laudon (2003, cited in Ray, 2008) define a knowledge worker as someone that designs or creates services within a firm and they identify three roles of knowledge workers within a firm. The first role identified by the above authors is keeping up to date knowledge of customers and industry

changes; the second role is advising employees to optimise operations to cope with customer and industry changes and the third role is to act as change agents that evaluate, initiate and promote change projects. According to Leibowitz (2001), competitive advantage is in the brainpower or intellectual capital in knowledge workers and tremendous synergies result from harnessing, capturing and securing this knowledge among employees to build the institutional memory of the firm.

Kokavcova and Mala (2009) identify that the most valuable knowledge in an organisation is in the heads of its employees and they encourage firms to identify these employees, to take care of them, to develop their special competences and to educate them through talent management initiatives. According to Delen and Al-Hawamdeh (2009), it is imperative to build collaborative systems capable of capturing knowledge that exists in the minds of people. Laudon and Laudon (2010) define knowledge residing in employees' mind that has not been documented as tacit knowledge and knowledge that has been documented in e-mail, voice mail, graphics, and unstructured and structured documents as explicit knowledge. They characterize knowledge as "sticky" because it is not easily moved and they also characterize knowledge as situational, not universally applicable and contextual, which means a worker must know when and how to perform a particular procedure.

Literature seems to identify the transfer of tacit knowledge from employees' minds to explicit knowledge in organisational memory as a difficult challenge. Gammelgaard and Ritter (2005) cite Alavi and Leidner (2001) on how individual memory is developed through observations, experiences, and actions and consist of knowledge from a network of concepts, individual experiences and implicit skills of how to do things. Gamelgaard and Ritter (2005) proceed to describe how skill can only be codified at individual level rather than organizational level and therefore cannot be stored in organizational memory. Since Darroch (2005) proceeds to cite Penrose (1959) to say an employee's knowledge is based on their skills, experiences and ability to absorb knowledge, it can be concluded that organizations will find it difficult to extract this tacit knowledge because it is primarily skill-based. Delen and Al-Hawamdeh (2009) assert this by stating that tacit knowledge residing within an individual is only observable via an individual's actions. However, they proceed to identify incidents where tacit knowledge has been tapped and harvested including interview sessions, narrations or story telling and knowledge exchange protocols or action protocols.

2.3.3.2. Information Systems

Ray (2008) states that knowledge management infrastructure consists of a data warehouse, content management, collaboration and access tools and identifies these as tools that efficiently capture, share and find information throughout enterprises.The capability to capture, store, retrieve, distribute and preserve knowledge helps firms improve their business processes and decisions (Laudon and Laudon, 2010). They identify enterprise content management to include corporate repositories of documents, reports, presentations, and best practices, as well as capabilities for collecting and

organizing semi structured knowledge such as e-mail. They proceed to describe how content management systems organize and store both structured and unstructured content, including e-mail; spreadsheets, word processing documents, and PDF document files, from its moment of creation until its ultimate disposition.

According to Ray (2008), organisations standardise information systems platforms across enterprises to improve and simplify knowledge resource management. He proceeds to describe how standardising databases allows firms to exchange data between employees and also allows firms to use data mining to extract, analyse and report on patterns and trends which helps to predict future behaviour and guide decision making and hence creates valuable knowledge for an organisation. Gammelgaard and Ritter (2005) enhance this argument by stating that databases serve as a link for function-based knowledge between workers. The above authors also highlight that using databases as a knowledge source has a benefit of recognising and storing patterns of information rather than information itself, which reduces the risk of information overflow and they also identify how systemising information makes the knowledge generated easier to use and more effective for the knowledge worker.

Leibowitz (2001), emphasises that most organisations need to have rigorous and comprehensive knowledge management methodologies and technologies to create knowledge management systems and initiatives. However, the author is quick to point out that just because knowledge management technologies and software is being used does not necessarily mean that employees are actually doing knowledge management because knowledge management involves a better understanding of management than technology. Walker and Christenson (2005) enhance this argument by stating that technology can only be an enabler and facilitator of getting people together to create and share knowledge rather than being a knowledge generator itself. According to Laudon and Laudon (2010), effective knowledge management is 80 percent managerial and organizational and only 20 percent technology."

2.3.4. Research Proposition

Project-based firms optimize their knowledge resources using

- Codification, Knowledge Sharing and Knowledge Transfer
- Classification, Indexing and Categorization
- Knowledge Workers and Using Information Systems

2.4. Challenges in Managing Project Knowledge

2.4.1. The Case for Knowledge Management in Project Based Firms

According to Ajmal, Kekale and Takala (2009) if knowledge is managed efficiently in project-based

firms, it can be used to decrease project time, improve quality and customer satisfaction, and minimize delivery times. When project based firms don't systematically secure knowledge gained in projects for later usage, they run the risk losing useful project experiences and knowledge with the end of the project and the result is that the firm will have invested heavily in innovative project work but will benefit nothing from evaluating and learning from it (Disterer, 2002)

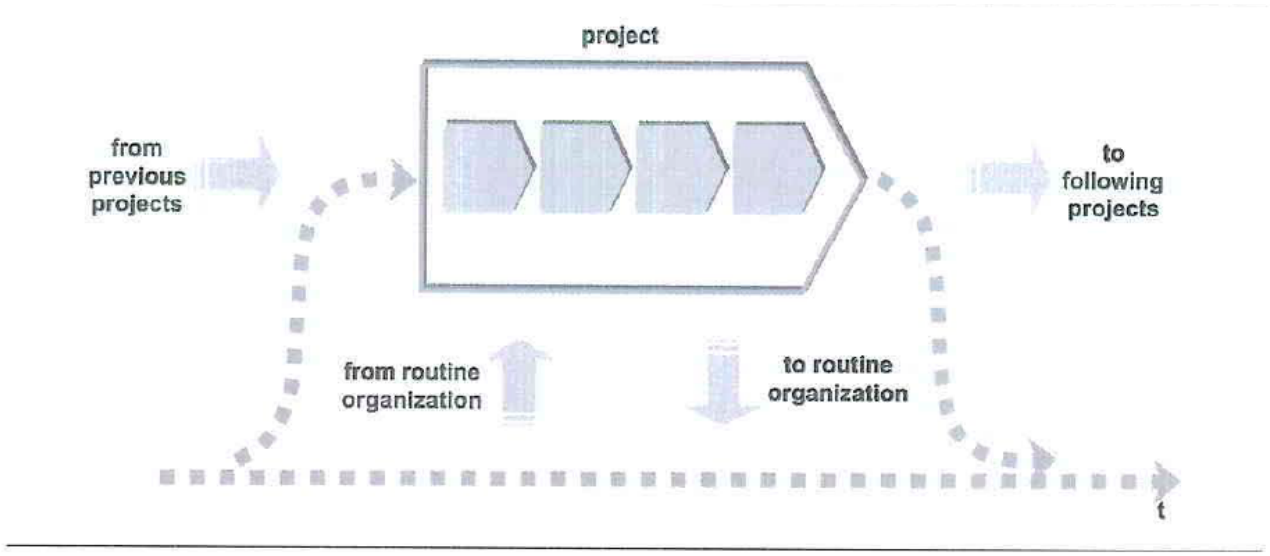


Figure 1: Knowledge transfer to and from projects (Disterer, 2002)

One difficulty in managing knowledge in projects is that the network of people from different contributing teams and organizations form and disband at the end of the project – much of their experience and knowledge dissipates as it is rarely recorded or available after the project is complete and since no continuity of knowledge to the project "client" there is lost opportunity to continue to create and share valuable knowledge through their project community (Walker and Christenson, 2005). Disterer (2002) also notes that it is difficult to find out which employees worked on a recently finished project, who were responsible for specific tasks, and where these employees are working now within the company - if at all.

Ajmal, Kekale and Takala (2009) identify another challenge of managing knowledge in projects as lack of sufficient time and resources for project post-mortems and documentation. They recommend strictly enforced rules that a project should not the regarded as over until the knowledge gained is properly managed and they also recommend a post-mortem at the end of the project by a qualified facilitator not previously involved in the project. Disterer (2002) also identifies that capturing knowledge and experiences at end of a project is pressed by time and budget restrictions and must be dropped because staff are needed for other following projects as soon as possible.

Disterer (2002) also identifies another difficulty in implementing knowledge management in projects

as lack of a central knowledge storage repository where existing knowledge can be accessed. He identifies how meeting points like groups, departments and branches no longer exist after the end of the project and how the documentation storage location of a specific project is sometimes even unknown. Disterer (2002) further cites Weiser and Morrison (1998) in identifying how project information is rarely captured, retained, or indexed so that people external to the project can retrieve and apply it to future tasks

Another difficulty in documenting project knowledge and experiences are individual and social barriers identified by Disterer (2002). While he acknowledges the value of analyzing failures and mistakes, he identifies the lack of an open and constructive atmosphere to articulate errors and he gives an analogy of a football team which can improve its performance by uncomfortably watching game films of matches it lost and paying attention to their mistakes.

2.4.2. Research Proposition

Project-based firms face the knowledge management challenges of

- Team Disbanding and Lack of Project Repository
- Post-Mortem Audits and Not Admitting Mistakes and Failures

2.5. Conclusion

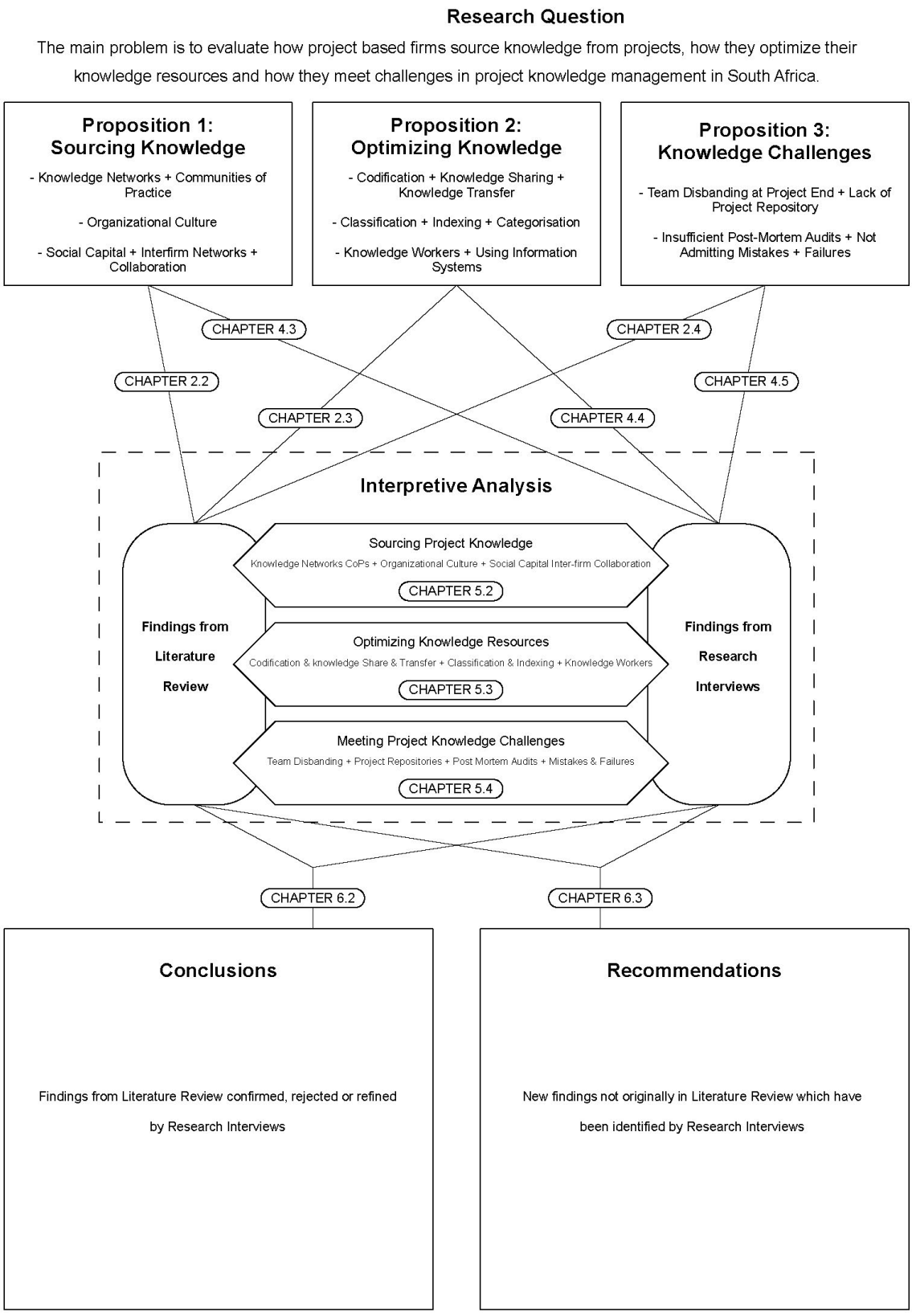


Figure 3. The Research Model

2.5.1. Research Proposition 1

Project-based firms source their knowledge using

- Knowledge Networks, Communities of Practice,
- Organizational Culture
- Social Networks, Inter-firm Networks and Collaboration

2.5.2. Research Proposition 2

Project-based firms optimize their knowledge resources using

- Codification, Knowledge Sharing and Knowledge Transfer
- Classification, Indexing and Categorization
- Knowledge Workers and Using Information Systems

2.5.3. Research Proposition 3

Project-based firms face the knowledge management challenges of

- Team Disbanding and Lack of Project Repository
- Post-Mortem Audits and Not Admitting Mistakes and Failures

3. RESEARCH METHODOLOGY

This chapter outlines the research methodology to be followed to conduct this study. It begins with a description of the method chosen and its implications for the research. This is followed by an explanation of the chosen research design, a discussion of methods used in data collection, analysis and interpretation. The chapter then concludes with a discussion on validity and reliability of the results.

3.1. Research Methodology

This study intends to use qualitative research methodology to gather appropriate data and answer the research questions. Babbie (2010; G9) defines qualitative analysis as the "non-numerical examination and interpretation of observations for the purpose discovering underlying meanings and patterns of relationships." According to Merriam (1998), qualitative research is interested in understanding how people make sense of their world and the experiences they have in the world. She proceeds to identify the characteristics of qualitative research to include revealing how all the parts work together to form a whole, which results in building a theory from observations and intuitive understandings from the field. Ospina (2004) identifies the advantages of qualitative research to include the ability to follow unexpected ideas and explore processes effectively, sensitivity to contextual factors and ability to study social meaning. This method has been chosen as appropriate for this study because of its ability to provide a complete, detailed description of a phenomenon, especially when the researcher knows what the meaning and experiences they are looking for?

3.2. Research Design

The methodological approach used in this study is a simple interpretive study. This will involve understanding the insider perspective and meaning behind the behaviour of project managers in capturing knowledge in project based firms. The aim of using this method is use flexibility to take account of unanticipated and to be capable to capture complexity. Wants to know about perceptions, feelings, attitudes, understandings, and meanings relating to human phenomena. Involves in depth interviews and/or questionnaires and content analysis of the transcriptions. According to Merriam (1998) interpretive study aims to identify recurrent patterns in the form of themes and categories.

This research will also be deductive in nature. The extensive literature review has led to deriving a theory on implementing knowledge management systems in project based firms and this has been structured into a series of hypothesis to be tested to extract meaning and understanding to the experiences.

3.3. Population and Sample

3.3.1. Population

The population for the study was project managers with more than five years experience managing projects in project-based firms that are constantly faced with the challenge of managing knowledge. The project-based firms that employed the project managers were randomly selected from diverse industries. The project-based firms are based in Johannesburg, South Africa but the project managers themselves have been exposed to diverse projects both locally and globally.

3.3.2. Sample and Sampling Method

Non-statistical sampling methods were used to identify project managers to be interviewed including judgement sampling, snowball/chain-reference sampling and convenience sampling. The sample has been purposefully selected to be a cross-sectional representation of project-based firms' experience in the implementation of knowledge management systems and therefore this is a purposive sample (Leedy and Ormrod, 2001). The selected project managers and their brief profiles are listed in the Table 2 and are identified by their initials for the sake of anonymity.

Table 2: Proposed Respondents

No	Name Initials	Industry	Company
1	Henning Rasmuss	Architecture	Paragon Architects
2	Nicholas Matejka	Project Management	Mstudio Projects
3	Anne Fitchett	Civil Engineering	University of the Witwatersrand
4	Lennard Gast	Information Technology	IBM
5	Clara Cruz da Almeida	Architecture	Afritects
6	Moreblessing Mberi	Architecture	Afritects
7	Pedri Lotz	Architecture	Henry Paine and Associates
8	Jason Frenkel	Construction Project Management	Jason Frenkel Project Management
9	Nangamso Mkumbuzi	Project Manager	Stauch Vorster
10	Martin Chinyowa	Project Management	4D Projects
11	Antony Soicher	Information Technology	University of the Witwatersrand
12	David Maina	Project Manager	Lefika Projects
13	Sibongile Manganyi	Property Developer	Indigo-Group
14	Bheki Ncube	Information Technology	ECH
15	Thuthukani Mbuyazwe	Information Technology	ICS

3.4. The Research Instrument

The research instrument will be a semi-structured interview as per the outline provided in Appendix A. The questionnaire is based on the findings in the literature review and the questions are primarily aimed at understanding the behaviour experiences and the meaning behind implementing particular structures, processes and networks in knowledge management tools and methodologies.

3.5. Procedure for Data Collection

About 25 potential participants were contacted telephonically or by electronic mail with a brief agenda and introduction to the purpose of the research and an invitation to voluntarily participate. The 15 respondents respondent listed in Table 2 above expressed their willingness to take part and they were sent an electronic mail containing details of the expected duration of the interview, request from participants to use the collected information and an agenda so they can prepare for a scheduled semi-structured interview. The interviews are scheduled to take place over a period of 2 months and each interview is not expected to exceed 45 minutes during working hours.

A pilot interviewed was conducted with 3 participants to test the validity and reliability of the research instrument. Where necessary, the research instrument was refined to be more aligned with the research hypothesis and to improve clarity as per the recommendations of the participants.

The interview was conducted through a questionnaire with probing questions aligning the discussion to the literature review and responses was recorded with the consent of the participants. The recording was then be transferred into a written transcript and the data within was treated with absolute confidentiality and information regarded as sensitive was omitted. The transcript was then sent to the respondent participants to verify transcription accuracy and, after auditing, the transcripts were then collated for data analysis.

3.6. Data Analysis and Interpretation

Leedy and Ormrod (2003) recommend identifying and explaining of common themes from participants after interviews in four steps. These include identification of statements that relate to the topic, grouping of statements into segments and categories, analysis of the various perspectives in the categories from participants, and consolidation of the various meanings into a composite description of a phenomenon.

Most of the data analysis ran concurrent with the data collection process. Transcripts from the interviews with the participants were analysed using a coding process. First, transcripts from recorded interviews were condensed into data summaries emphasising key points for data analysis. Then a codebook and colour code was used to identify common terms and themes across the interviews. All

data was then organised using the coding system and analysed to identify the factors implementing the successful implementation of knowledge management systems.

3.7. Validity and Reliability

Leedy and Ormrod (2001) define validity as whether the research instrument measures what it is supposed to measure and they define reliability as the accuracy and consistency with which the research instrument produces results.

3.7.1. External Validity

Leedy and Ormrod (2001; 105) define external validity as "the extent to which its results apply to situations beyond the study itself" and they emphasise that findings from a study need to be generalizable to ensure external validity. The generalisation of the findings in this study is threatened by the fact that knowledge management systems have to store diverse nature of the content that because of the different knowledge requirements of project based firms across various industries. For example, the repository of an architectural project-based firm might emphasise on storing graphics, drawings and photos while the repository of a software engineering firm might focus on storing modulated programming codes and scripts for reuse. The storage requirements and processes of scripted code are different from those of graphics, drawings and photos and this could affect implementation methods and best practices, which would render this study as not generalizable. The study addresses the issue of generalisation by specifically asking the participants if there are any specific and unique knowledge requirements and how they affect implementation and if benchmarking with implementation processes from other industries can neutralise that particular industry's unique challenges in knowledge management.

3.7.2. Internal Validity

According to Leedy and Ormrod (2001; 107), internal validity tries to "minimise alternative explanations for the results obtained" and it refers to the extent to which a research instrument performs its intended function or measures what it is supposed to measure. This aspect was addressed primarily in the literature review from which the research instrument is derived. The literature review and the derived research instrument have been framed to approach the study through the root definition of implementation including tools and methodologies, through the root definition of knowledge management systems including structures, processes and networks and an understanding of the root need of knowledge management in project-based firms. As a result of deriving the literature review and research instrument from first principles, this study measures what it is supposed to measure; implementation of knowledge management systems in project-based firms.

3.7.3. Reliability

According to Leedy and Ormrod (2001), reliability refers to the extent to which a similar research conducted in a different time or space would produce consistent results. Although a semi-structured research instrument is used, the researcher personally conducted all the interviews and interpretation of the researcher played a significant part in the analysis, which influences the reliability of the data.

3.8. Research Timetable

Table 2: Research Timetable

	02 Oct 11	17 Oct 11	01 Nov 11	14 Nov 11	5 Dec 11	02 Jan 12	6 Feb 12
Finalise proposal							
Gain approval							
Gather data							
Do data analysis							
Write report							
Finalise report							

3.9. Consistency Matrix

Table 3: Consistency Matrix

`RESEARCH PROBLEM: The main problem is to evaluate how project based firms source knowledge from projects, how they optimize their knowledge resources and how they meet challenges in project knowledge management in South Africa.					
SUB-PROBLEM	LITERATURE REVIEW	RESEAERCH PROPOSITIONS	DATA SOURCE	DATA TYPE	ANALYSIS
Analyze how project based firms source knowledge from projects they undertake	Knowledge Networks Communities of Practice Organisational Culture Social Capital Firm Interaction and Collaboration	Project based firms source their knowledge using Knowledge Networks, Communities of Practice, Organizational Culture, Social Networks, Inter-firm Networks and Collaboration	Semi-Structured Interview	Qualitative Data	Data Reduction Data Coding Categorizing Deducing Meanings
Analyze how project based firms optimize their knowledge resources in projects they undertake	Knowledge Transfer Knowledge Sharing Codification Classification and Indexing Knowledge Workers Information Systems	Project based firms optimize their knowledge resources using Codification, Knowledge Sharing and Knowledge Transfer, Classification, Indexing and Categorization, Knowledge Workers and Using Information Systems	Semi-Structured Interview	Qualitative Data	Data Reduction Data Coding Categorizing Deducing Meanings
Evaluate the challenges that project based firms face in managing project knowledge	Team Disbanding at Project End Insufficient Project Post-Mortem Audits Lack of Project Repository Not admitting Mistakes and Failures	Project based firms face the knowledge management challenges of - Team Disbanding and Lack of Project Repository - Post-Mortem Audits and Not Admitting Mistakes and Failures	Semi-Structured Interview	Qualitative Data	Data Reduction Data Coding Categorizing Deducing Meanings

4. PRESENTATION OF RESULTS

4.1. Introduction

The purpose of this chapter is to summarise the results obtained from the semi-structured interviews with the respondeds. A total of fifteen respondents contributed to this study. The findings of the primary data are presented below using tables and diagrams to augment the associated text. Throughout the discussion, quotes from the respondents are included to emphasize the findings and to give additional insight.

The findings on each of the three propositions are presented in the same order as they were presented at the conclusion of Chapter 2. While the findings are related back to the propositions, this research does not intend to rank findings in order of importance. However, the findings are listed in a format and structure that relates to the data reduction, coding and coding that was conducted on the information in the interview transcripts.

4.2. Demographic Profile of the Respondents

The sample in this research consisted of fifteen individuals who primarily worked in project based firms. Because of the subject matter of the research, all fifteen respondents were knowledge workers who were directly involved with conducting operational roles and tasks in project environments. This sample was overwhelmingly skewed towards respondents with experience in diverse projects which involved extensive recording of information because of its potential to be transferred into knowledge.

Interviews were conducted in Johannesburg only although many of the respondents had extensive experience of undertaking projects in other provinces and cities in South Africa. One of the primary requirements was for each respondent to have at least five years experience of working in a project based firm. The nature of the sample design was such that the chosen respondents represented the most relevant and diverse experience in project scope and had the best required knowledge on how to source knowledge, optimise knowledge resources and meet challenges in project knowledge management.

Table 4: Respondents in Project Based Firm by Role

Role in Project Based Firm	Number Interviewed
Project Management Consultant	4
Project Leader in Project Based Firm	6
Project Planning, Implementation and Administration	2
Storing Retrieving and Maintaining of Project Knowledge Repository	2
Knowledge Worker in Project Based Firm	1

4.3. Results Pertaining to Research Proposition 1

Project based firms source their knowledge using

- **Knowledge Networks, Communities of Practice,**
- **Organizational Culture**
- **Social Networks, Inter-firm Networks and Collaboration**

Table 5 - Responses to Research Interview Questions for Proposition 1

Knowledge Networks and Communities of Practice	Organizational Culture	Social Capital, Firm Interactions and Collaboration
Calling a consultant is quicker because knowledge exists in people's head and takes too long to write down, rather specialise in how to extract it from people	People are the key. Always work with best of best because substandard people result in problem culture Adopt culture where its more important to learn how to get answer than answer itself. Store what's useful and usable	creates bond and relationship infrastructure to share knowledge. Stick together to share more. Enhanced trust and openness are ideal for knowledge transfer. Social barriers mean less sharing. No glue means no knowledge sharing
Knowledge repositories avoid reinventing the wheel by reusing what's done before but knowledge need to be applied in context and adapted to suit not like formula	Geographic national culture affects knowledge sharing in our organisation. In UK branch knowledge is power and this limits knowledge sharing but in our South American branch knowledge is freely shared	Understanding communicates intent and boosts knowledge extracting. Its all about project team members' personality. It helps to know strengths weaknesses, to respect others job and to have team members easy to be work with
Real and informal knowledge shared in conference tea breaks because of dynamic dialogue that is diversified and not linear. Brainstorm to extract knowledge . Consulting has benefit of leading you on which further questions to ask.	If a company policy focuses on technology, there are technical filters to the quality of knowledge stored but if company policy focuses on innovation there is free flow of knowledge	You need to constantly review relationships with performance appraisals so you don't take them for granted.
Websites act as knowledge sharing portal with experts - becomes matter of asking right questions. Web portal expands knowledge network cheaper than physical network + current + guide to more knowledge saving time + travel costs.	Objectives and values dictate brand and systems and knowledge shared. In a rigid culture knowledge is about induction into how we do things but in an innovation culture enthusiasm affects knowledge gaining and sharing. Innovative systems are exciting to use to share knowledge instead of systems where you are forced to share knowledge	Working with the same people enhances brand signature
Network + CoP knowledge more detailed and more practical since value of sharing knowledge from work experience comes from the projects themselves.	We run our firm like a family which fosters teamwork and encourages knowledge sharing + respect to help follow methodologies and processes and standards. office family culture includes open plan + people working in close proximity	Knowing who to call is better than knowing the answer. It's also important to know how to articulate the question.
Have communities of practice and centres of excellence for all key departments in the company's industry of operation		You need quality and specialised people to absorb + acquire better quality knowledge.
Cops and knowledge networks need to have a big movement to follow for it to be effective and focused.		
CoPs + Knowledge Networks updates firms on latest trends, breakthroughs and innovations + stimulates quest for knowledge + evokes to search more and guides firms to different ways of doing things. CoPs + Knowledge Networks also fosters innovation and always teach something new		

Three questions were posed in relation to Proposition 1. The Questions were as follows.

1. Do you consider Knowledge Networks (consulting experts, websites and previous project archives) and Communities of Practice (conferences, online newsletters and sharing of work experiences) to be a useful when sharing source of project knowledge? If so, describe how these are useful.
2. Does Organisational Culture contribute to sourcing knowledge from projects? If so, how does it help?
3. Do you source knowledge from social capital, Firm Interactions and Collaboration? If so, to what extent?

The responses to the questions above are tabled in Table 5 above. Through a process of data reduction, data coding and categorizing, the interview responses were streamed to 6 key themes. The response themes which emerged from questions on sourcing knowledge in project based firms are interaction, relationships, diversity, brand, framework and content.

The response theme of interaction emphasised the efficiency of interaction as being able to direct dialogue to get a quick response which is more suited to a knowledge request. The response theme of relationships emphasised the importance of building strong ties through a sociable environment to promote in-depth comunication and hence foster knowledge sharing. One respondent supported this by saying, “We have made our organisation to run like a family. Running our firm like a family minimises risk of losing staff by being too bossy. A family environment enhances teamwork with spirit of together and we share information and knowledge and it helps us to be innovative in projects”. Another respondent enhanced the value of relationships by saying, “Trust me first. Inter-firm knowledge sharing is dead because organisational distance limits knowledge sharing because the relationships are too formal. The level and nature of organisational qualitative relationships dictates knowledge sharing. You need to culturalise the organisations to share knowledge. In our practice, my boss invites consultants to informally stay in his house and merge shared culture before working together.”

The response theme of diversity highlighted how different people increase the quality of knowledge accumulated, hence the need to choose employees carefully because diversity dictates culture. One respondent went on to highlight this by saying, “Always work with the best of the best. Substandard people result in problem culture”. Another key response theme to sourcing knowledge in project based firms was how brand is enhanced by working with the same people because they share knowledge and how brand dictates the type of knowledge a company shares. The response theme of frameworks dictate the quality of knowledge stored through focusing on a revolutionary knowledge

movement and through frameworks for dividing knowledge into speocialty areas. One respondent explains how frameworks help dictate knowledge stored by saying, “We have Communities of Practice and Centres of Excellence for every field we are in. We have Centres of Excellence for mainframes, for concepts and for banking. There are formal processes to reposit knowledge and skills focussing on industry and product. You just need to go into the portal and search. There is an enormous amount of information and this orders our knowledge.”

The final response theme to sourcing knowledge in project based firms was content. Emphasis on content was important because knowledge from shared experience is more practical and more detailed and its in understanding and maniputaing content that innovation is fostered.

A cognitive map of response themes to sourcing knowledge in project based firms is in Figure 4 shown below.

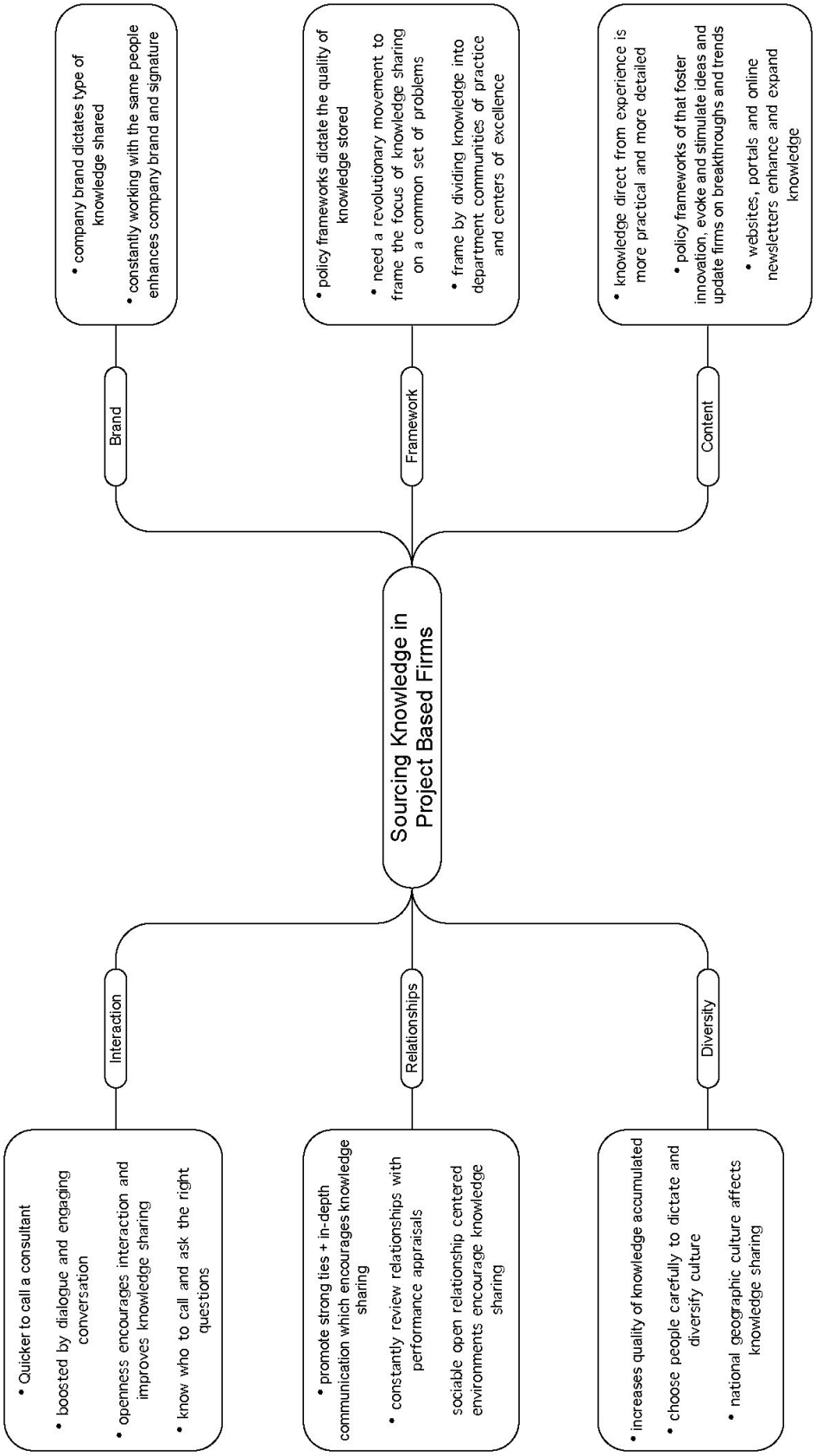


Figure 4 – Cognitive Map of Sourcing Knowledge in a Project-Based Firm

4.4. Results Pertaining to Research Proposition 2

Project based firms optimize their knowledge resources using

- **Codification, Knowledge Sharing and Knowledge Transfer**
- **Classification, Indexing and Categorization**
- **Knowledge Workers and Using Information Systems**

Table 6 - Responses to Research Interview Questions for Proposition 2

Codification, Knowledge Sharing and Knowledge Transfer	Classification, Indexing and Categorization	Knowledge Workers and Using Information Systems
Codification links bundles of information together to get better grip of what we know	Great classification is backbone to knowledge repositories that help deliver projects. Classifying knowledge manipulates what we know to create new knowledge and makes firm more innovative. Classifying knowledge identifies and benchmarks specific knowledge areas which need to be improved	Appreciate knowledge workers for their knowledge and respect and acknowledge and applaud contribution. Invest in people and give them shares to retain them
Needs management enforcing of drawing and document standards through office manual, processes guidelines and indexes . List every process like recipes which become checklists because project management very methodical.	Tagging - don't put knowledge into index but rather put index onto knowledge. Quite powerful way of indexing knowledge.	Knowledge Workers proactively learn from exposure to projects and observation. Experience very important. The longer someone in firm the more knowledge they absorb. Need interested as main motivation in building knowledge.
Use of discussion rooms, collaboration forums to monitor knowledge accumulation, informal talks, social events to share experiences, consultant workshop and brainstorm sessions and internal directories of people in hierarchy level	Mandate staff to know structure + how to access knowledge + hundreds of knowledge courses ease classification gets knowledge onto fingertips	Formal protocols, processes and guidelines must force workers to write what they know in libraries and regularly tested. Workers must also learn to ask the right questions, storytelling + sharing mistakes + lessons.
Knowledge sharing shapes structures process + production and helps quality control + time effeciency more than building knowledge. Also helps new users accumulate knowledge	Our process and workflow is embedded with classification and indexing in its methodology. Can see differences instantly. Our work already indexed through highliting comments and logical sequence and structure of convention.	All key irreplaceable people have junior under them who does bulk of work to ensure knowledge transfer + continuity. Also maximise the knowledge of very talented people to be shared with firm before they leave.
Meetings and coordination allow interaction and feedback and debate which has effect of dynamically molding knowledge. Integrate social informal knowledge sharing into formal work time and workshop our projects to boost internal knowledge. Also integrate lots of in-house training	Must be simple and easy to use – the simpler the better – must not be too complex. You must only go through a maximum of 4 folders to access information – not 10 folders.	Explain rationale + thinking behind every process + teach principles. Train + emphasise productive use of software especially to top management and instantly enforce what you have learnt. Get suppliers to come discuss products
	Very strict and particular because we use project archive structure as main way to store knowledge in context so easier to understand and easier to access. Classifying knowledge is more about time management than process management so quick access is key to knowledge management.	Clients now demand and enforce standardising systems across project teams to ensure collaboration and limit people working as islands to boost efficiency in knowledge flow. Incompatibility hinders flow of information and knowledge and helps avoid losing information.
		use databases and knowledge management systems and classification to store what you learn

Three questions were posed in relation to Proposition 2. The Questions were as follows.

1. Is codification, knowledge transfer and knowledge sharing used to maximum potential for projects in your organisation? If so, how?
2. Does indexing, classification and categorisation help maximise the way you use knowledge in project? If so, how?

3. Does your organisation use the knowledge workers and information systems to extract the maximum possible knowledge? If it does, how?

The table above shows the interview responses on optimizing knowledge in project based firms after data reduction, data coding and categorizing. Seven response themes emerged from the interviews responses as shown on the cognitive map below. The key response themes are protocols, exposure, structure, process, discussion, design and packaging.

The response theme on protocols focused on standardising methods of storing lessons, experiences and mistakes so as to ease collaboration and knowledge flow. One respondent ellaborated, “Having a knowledge base of methodologies perfects the way you handle knowledge projects. Even a newcomer without knowledge can get to understand simply by using process and systems”. Another key theme was how exposure through observation to projects and through juniors working under talented and experienced employees helped project based firms to optimise building and sharing knowledge between employees. One respondent gives an example, “In one case we hired a talented and skilled individual. He had a special skill but we profiled him and calculated we will probably have him around for two years before he moves on to another company. Through exposing him to working with as many employees as possible, we extracted knowledge from him into the company”.

Also important was the response theme on structure which classifies knowledge using tagging and codes. Structuring optimises knowledge resources to help deliver projects faster, to create new knowledge, for easier retrieval and to improve efficiency in receiving and sending information. One respondent whose firm had particularly benefited from structuring knowledge said, “We have knowledge that we make available to the public over the internet. Then there is knowledge that we share with our business partners because we give people we work with access to our research. Then there is internal knowledge. Our organisation spends US$ 9 billion on research and development and files 2500 patents a year so we are a knowledge factory and need systematic knowledge codification and transfer”. Another response theme highlighted for optimising knowledge resources in project based firms is process. Process enhances production and innovation, accumulates knowledge in newcomers and can be used to promote applying rationale, thinking and unerstanding to gaining knowedge. The response theme on discussions promotes the sharing of knowledge through internal directories, conversation and acknowledgement. The response theme on design emphasises how knowledge management systems must be designed to be simple and easy to use and not too complex and how knowldge management systems can also be designed to promote rationale and thinking and understanding principles as they are used. The response theme on packaging tries to grip knowledge so it can be manipulated, stored and retrieved.

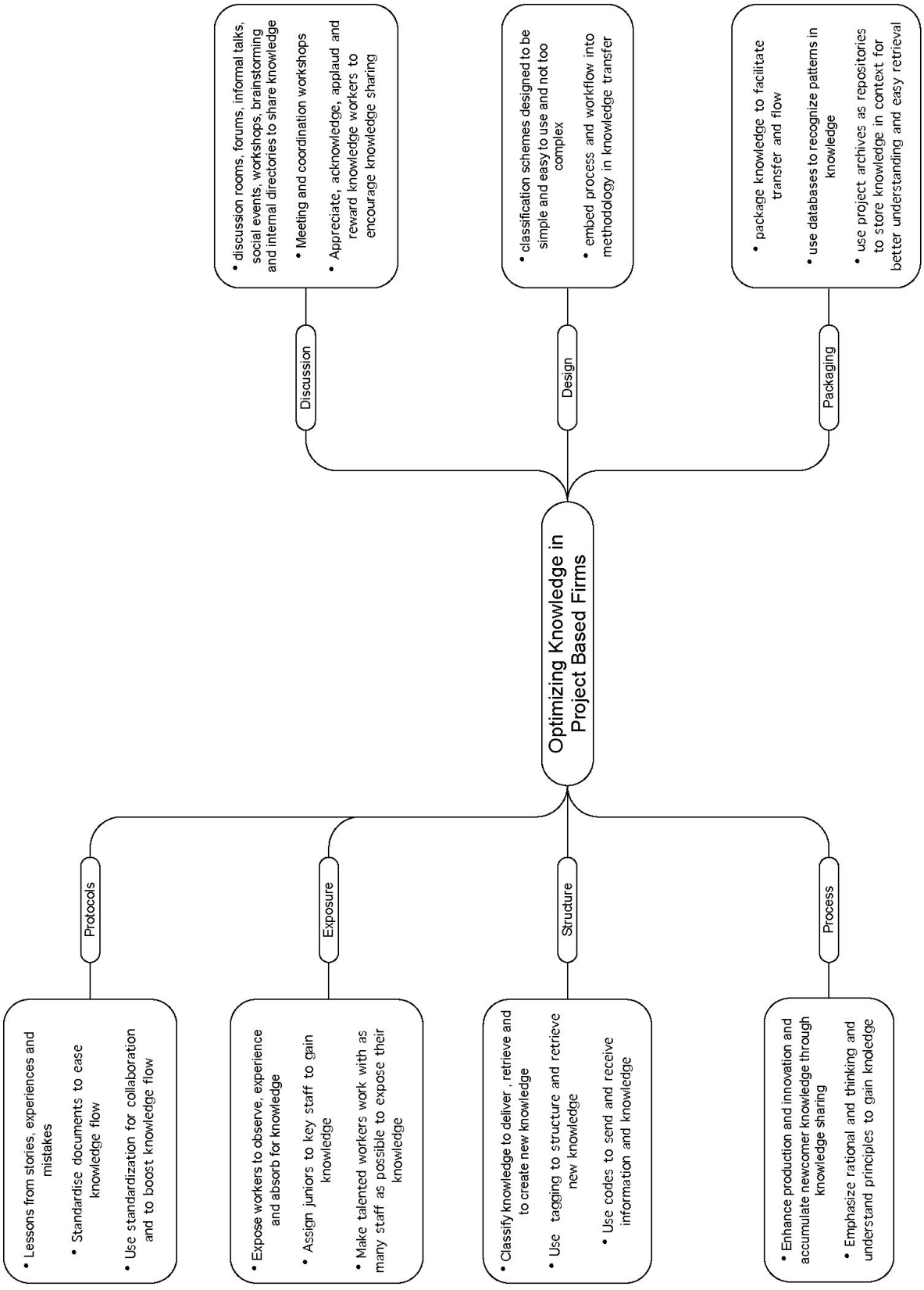


Figure 5 - Mind Map of Research Interview Findings for Proposition 2

4.5. Results Pertaining to Research Proposition 3

Project based firms face the knowledge management challenges of

- **Team Disbanding and Lack of Project Repository**
- **Post-Mortem Audits and Not Admitting Mistakes and Failures**

Two questions were posed in relation to Proposition 3. The Questions were as follows.

1. Does the disbanding of project teams at the end of projects and the lack of a common project repository affect how you manage knowledge in your organisation? If so, how does it affect you and how do you address this?
2. Do insufficient project post-mortem audits and difficulties of people admitting their failures and mistakes affect how you manage knowledge in your projects? If so, how does it affect you and how do you address it?

Table 7 - Responses to Research Interview Questions for Proposition 3

Team Disbanding and Lack of Project Repository	Post-Mortem Audits and Not Admitting Mistakes and Failure
Handover document with reports by consultants, drawings, before and after pictures. Formal closeout document and closeout filing signed by everybody and legally given to client. Client is not going to pay us if report is poor quality.	Have weekly meetings to discuss progress + grievances and address mistakes and errors. Allow time to expose common problems. Do project audits as you go along not just at end.
There needs to be contact info of everyone who worked on a project at the end	Post-mortem audits facilitated by outsider. People must only participate only at expert level. Highly technical interviews
Store all knowledge in original format so context of knowledge is not lost. Storytelling is critical. Capture spirit of project by documenting as much correspondence as possible and publish into book.	Create right environment to admit mistakes and to criticise quality of work with clear intent of learning
Online repositories but expensive. Storing easy but retrieving is the challenge. Focus on paper-like retrieval systems because these are best format to access.	Audits attract criticism to ourselves and feel awkward so we avoid them altogether
Gather knowledge constantly as project goes along so only few remaining files to collect when project ends. Dedicate person to archive + retrieve project knowledge. Project leader constantly checks value + quality of knowledge	Consultants have own audit and client and end user have own audit. As internal consultants we openly review ourselves but client review board is more about defending actions
Quantify the knowledge value for project end and use this to validate building project closeout into budget as time and cost item	Conduct post occupancy market research to see if customer happy with our product linked to maintenance, also audit products not just processes
	People who check are always at higher level than people who implement
	Focus in understanding process and methodology of delivering projects and that's what we audit. Never really person that fails but rather system that fails. Standardise process so its easier to find method flaws. Never one person but always interlink in group of people
	There is a fear of rekindling old wounds and damaging relationships with key knowledge workers who may have messed up on one project but are generally very reliable.

The interview responses for meeting the challenges of project knowledge management also went through a process of data reduction, data coding and categorising and the responses are shown in the table above. Six response themes emerged from the interview responses regarding challenges in

managing knowledge in project based firms. The key response themes were documentation, coordination, review, quality, relationships and evaluation. The key response themes to meeting the challenges of knowledge management in project based firms are shown on the cognitive map below.

The response theme on documentation emphasises the storing of all knowledge in its original format and storing the electronic in as similar as possible structure to the paper filing with the handover document being the main end product. The response theme on coordination encouraged knowledge management in project based firms to be ongoing including regular update of contact information and documents and weekly meetings where mistakes and lessons are captured. One interview respondent said, “Don't capture mistakes and failures when a project is done because it is too late. Capture them during the process of implementation. If you capture mistakes and errors at the end of a project you will miss half of them.” Another response theme was review and this highlighted how audits are awkward but necessary to improve knowledge gathering and performance and how people who check must always be at a higher level than people who implement.

The response theme on quality emphasised the auditing of both the process and the product to learn from mistakes and grow the firm’s knowledge base. One interview respondent explains the need for this process by saying, “Its never one person’s fault. It’s the system that fails so its about correcting the system so you have to fix culture and the will of people. Post occupancy reports for project managers must facilitatate learning on how products respond to needs.” Another respondent highlighted the value in improving quality by saying, “The key point is – are we repeating the errors of previous projects? Project audits attract criticism to ourselves. If we identify and fix problems we should then celebrate the opportunity for improvement”.

The response theme on relationships highlighted the separation of audits with the client from internal consultant audits and also the potential to damage relationships with key knowledge workers during audits. One respondent explained, “There is a fear of rekindling old wounds and damaging the relationship you have with your knowledge workers”. Another respondent also highlighted the value of managing relationships during audits by saying, “We learnt to study the client’s personality and character. Some clients are so demanding and if you exert and translate that pressure on the staff you could lose some great people. Protect your staff from difficult clients”. A final response theme was evaluating the benefit of project close-outs and project audits to knowledge management so as to justify need and allocate budget, cost and scope in project planning. One respondent explained that, “You need to have that important last phase of capturing lessons learnt in a project. You must quantify

the value of knowledge you gain at the end of the projects and when you know its worth you can validate creating a budget and time to implement it".

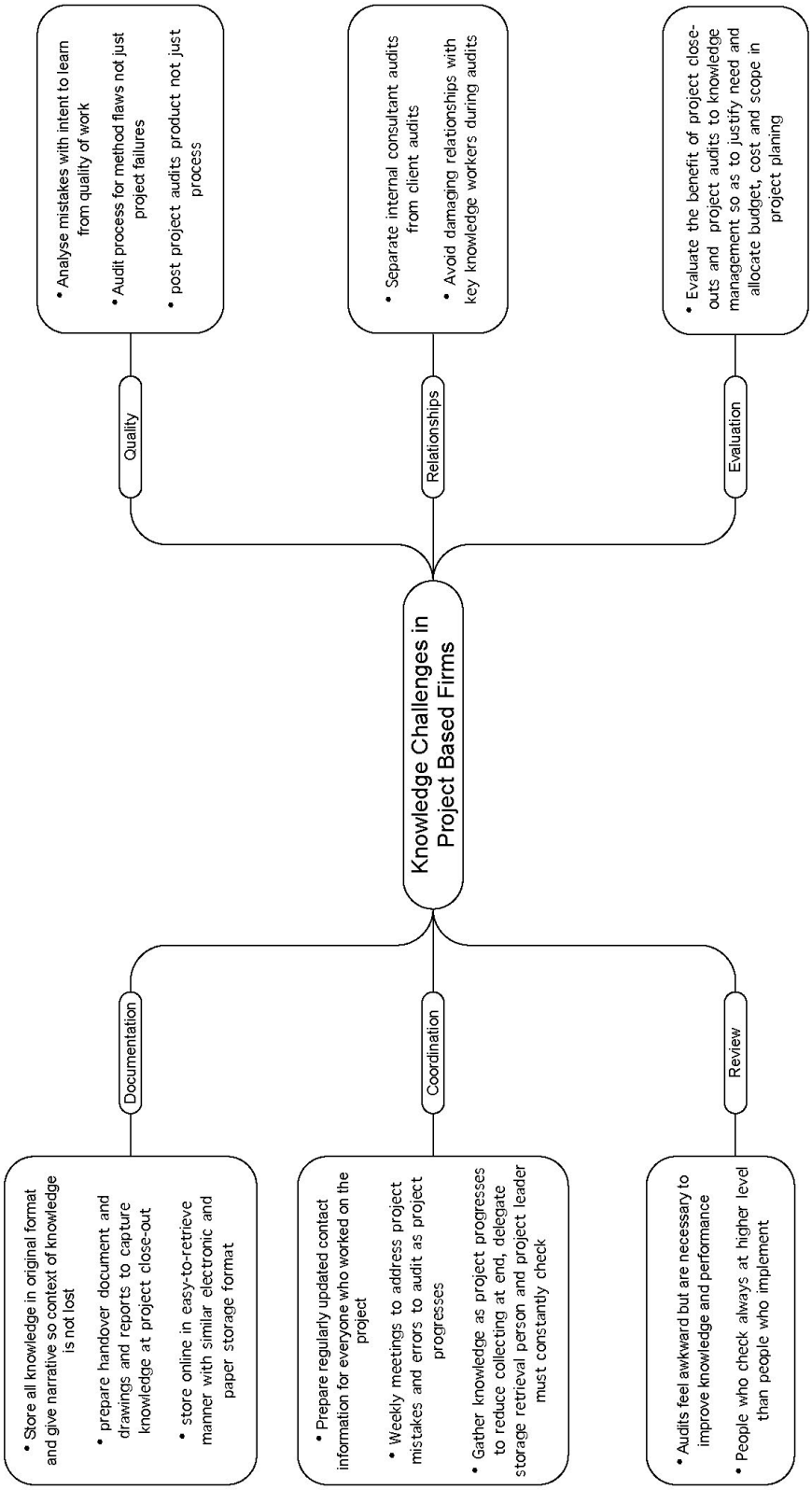


Figure 6 - Mind Map of Research Interview Findings for Proposition 3

4.6. Conclusion of the Presentation of Results

This chapter presented the results of interviews that were conducted to investigate the three propositions of the research. The interviews were conducted on fifteen knowledge workers who had at least five years experience in project-based firms. The interview responses went through a process of data reduction, data coding and categorisation. The responses relating to each proposition were presented in tables. The categorisation resulted in key response themes which were presented in diagrams.

On the first proposition of sourcing knowledge from projects, the six response themes which emerged are interaction, relationships, diversity, brand, framework and content. On the second proposition of optimising a firm's knowledge resources for projects, the seven response themes which emerged are protocols, exposure, structure, process, discussion, design and packaging. On the third proposition of meeting the challenges of managing knowledge in project based firms, the six response themes that emerged are documentation, coordination, review, quality, relationships and evaluation.

5. DISCUSSION OF RESULTS

5.1. Introduction

The interpretation of the results of this research is based on the findings from the interviews, and these findings are compared and contrasted with the findings revealed in the literature review. The results of the propositions will be discussed by commenting on the responses to each question as they relate to the proposition.

5.2. Discussion of Interview for Research Proposition 1

Project based firms source their knowledge using

- Knowledge Networks, Communities of Practice,
- Organizational Culture
- Social Networks, Inter-firm Networks and Collaboration

5.2.1. Knowledge Networks + Communities of Practice

The general findings from the interviews confirmed the literature review. The common findings confirmed by both the interviews and literature review (Walker and Christenson, 2005) was that there is unique value in sourcing knowledge from people through knowledge networks and comunities of practice because of the dynamic nature of dialogue, and this has a benefit of chanelling and directing a person to the knowledge they want to extract. The interviews and literature review both confirmed that repositories built from knowledge networks and CoPs avoid unecessary work through reusing what is known and what has been done before (Oz and Jones, 2006). Interviews and the literature review also confirm that website portals are useful in expanding knowledge networks and with their use, extracting knowledge becomes a matter of asking the right questions (Laudon and Laudon, 2010). This enhances another finding which is supported by both the interviews and the literature review which emphasises the need for a big movement or topic to follow with specific problems or goals to address so as to align knowledge extraction and decoding (Gammelgaard and Ritter, 2005). Finally, both the literature review and the interviews confirm that knowledge from knowledge networks and communities of practice inform knowledge workers of trends, breakthroughs and innovations and, through stimulating knowledge workers to do things differently, it fosters them to be innovative and evokes them to search for new ideas, techniques and decision making behaviour (Werr and Stjernberg, 2003 cited in Taminiau Smit and de Lange, 2009).

Table 8 - Comparison of Findings: Knowledge Networks and Communities of Practice

Findings in Research Interview	Findings in Literature Review
Calling a consultant is quicker because knowledge exists in peoples head and takes too long to write down, rather specialise in how to extract it from people	Knowledge is also knowing where to find information about the subject, including an online directory of subject matter experts
Knowledge repositories avoid reinventing the wheel by reusing what's done before but knowledge need to be applied in context and adapted to suit not like formula	About half of work done by knowledge workers already done elsewhere in organisations - workers are trying to solve same problems other workers have already solved
NOT REVEALED IN INTERVIEWS	Pruning knowledge before storing avoids information overload and accumulates of best practices and methods and tools that lead to innovation
NOT REVEALED IN INTERVIEWS	Lessons learned and recorded invaluable when trying to avoid making the same mistake twice + greatly improves response time when handling customer problems + effective in handling unstructured problems
Real and informal knowledge shared in conference tea breaks because of dynamic dialogue that is diversified and not linear. Brainstorm to extract knowledge . Consulting has benefit of leading you on which further questions to ask.	Learning through other people makes knowledge a property of relationships. Bounded together by need to know what others in community know. Operate with informal goals, a common language, shared understandings
Websites act as knowledge sharing portal with experts - becomes matter of asking right questions. Web portal expands knowledge network cheaper than physical network + current + guide to more knowledge saving time + travel costs.	CoPs greatly depend on software environments that can facilitate group education, conferences, online newsletters, day-to-day sharing of experiences and problem solving techniques to enable collaboration and communication.
Network + CoP knowledge more detailed and more practical since value of sharing knowledge from work experience comes from the projects themselves.	*NOT REVEALED IN LITERATURE REVIEW*
Have communities of practice and centres of excellence for all key departments in the company's industry of operation	*NOT REVEALED IN LITERATURE REVIEW*
Cops and knowledge networks need to have a big movement to follow for it to be effective and focused.	Knowledge needs a searching and decoding process to transfer to format that is relevant to particular problem or goal
CoPs + Knowledge Networks updates firms on latest trends, breakthroughs and innovations + stimulates quest for knowledge + evokes to search more and guides firms to different ways of doing things. CoPs + Knowledge Networks also fosters innovation and always teach something new	CoPs + Knowledge Networks act as spawning ground for new ideas, techniques and decision making behavior
NOT REVEALED IN INTERVIEWS	Reduces learning curve for new employees by providing contacts with subject matter experts and access to a community's established methods and tools + filtering information for newcomers

However, there were findings in the literature review which were not supported by the interviews. One key finding from the literature review is the value of knowledge in avoiding repeating the same mistake twice (Ray 2008), how knowledge greatly improves response time in handling customers' problems, and how effective knowledge is in handling unstructured problems (Retna and Ng, 2011). A possible explanation of why this was never addressed in the interviews is that because projects are unique and are carried out in controlled environments, it is not necessary to build knowledge repositories as it would be for routine operational processes. Another finding in literature review not supported by the findings in the interviews is the pruning of information into knowledge before storing it in repositories and the accumulation of best practices and methods and tools that lead to innovation. This is possibly because projects have a specific scope to which a budget and timeframe are set and hence there are no resources assigned to these valuable tasks. A final finding from literature review that is not supported by the interviews is how knowledge networks and communities of practice

reduce the learning curve for new employees by providing access to subject matter experts and the community's established methods and tools. A possible explanantion for this is that according to codification, knowledge sharing and knowledge transfer, learning in project environments comes from exposure to project environment and actual observation and problem solving in projects rather than exposure to knowledge networks and comunities of practice. A proposed solution is to repackage the knowledge repository into courses with case studies and practice scenarios and exercises so as to give newcomers practical hands-on experience of learning by doing.

Two findings were exposed by the interviews which were not exposed in the literature review. The first is that the benefit of knowledge from knowledge networks and CoPs over other knowledge sources is that it is more detailed and more practical because it is rooted in sharing work experiences hands-on and direct from project environments. This is probably the most tacit form that knowledge about any industry can take and this form of knowledge serves as a direct testimony of what works and what doesn't. The second finding from the interviews not exposed in the literature review is the idea of further subdividing an organisation's knowledge repository into centres of Excellence and Comunities of Practice for every industry that the organisation is involved in. This has an effect of sharpening the knowledge focus of an organisation while diversifying their knowledge base to suit their specialisation focus while still maintaining the goal of building a common knowledge repository.

5.2.2. Organisational Culture

Both the literature review and interviews confirm that people and culture are the key factors that determine the success or failure of knowledge management initiaives (Rubenstein-Montano, et al, 2001), with interviews further enhancing that working with substandard people results in a problem culture. Both interviews and literature review also confirm that organisational culture dictates the type of knowledge that an organisation reposits and that the values and brand and philosophy of the company dictate the knowledge shared (Earl, 2001 cited in Donate and Guadamillas, 2010). The interviews and literature review also both confirm that fostering a sociable environment builds relationships and this encourages knowledge sharing (Leibowitz, 2001). Two companies interviewed actually went to the extent of orientating project consultants into the organisation's culture before working with them.

Table 9 - Comparison of Findings: Organisational Culture

Findings in Research Interview	Findings in Literature Review
People are the key. Always work with best of best because substandard people result in problem culture Adopt culture where its more important to learn how to get answer than answer itself. Store what's useful and usable	People and culture are driving factors that determine success or failure of knowledge management initiatives.
Geographic national culture affects knowledge sharing in our organisation. In UK branch knowledge is power and this limits knowledge sharing but in our South American branch knowledge is freely shared	
If a company policy focuses on technology, there are technical filters to the quality of knowledge stored but if company policy focuses on innovation there is free flow of knowledge	Culture constitutes a general framework in which a company's knowledge management strategy and policy is established
Objectives and values dictate brand and systems and knowledge shared. In a rigid culture knowledge is about induction into how we do things but in an innovation culture enthusiasm affects knowledge gaining and sharing. Innovative **systems** are exciting to use to share knowledge instead of systems where you are forced to share knowledge	Organisations must establish what specific values should be developed and how they should be adjusted to the knowledge management practices implemented by the firm
We run our firm like a family which fosters teamwork and encourages knowledge sharing + respect to help follow methodologies and processes and standards. office family culture includes open plan + people working in close proximity	A sociable, encouraging, open, relationship work environment encourages open information exchange and promotes the sharing of knowledge. A supportive culture is 90% of knowledge management effort and information systems 10%.
	A shared space for interaction that can be physical, virtual or mental where embedded knowledge is acquired through individuals' experience or reflections on others' experience.

However, one finding from the literature review which was notably missing from the interviews was emphasis on a physical, virtual or mental shared space for interaction for acquiring embedded knowledge through shared experiences (Kokavcova and Mala, 2009). A possible explanation for this is that project management has extensive frameworks which exhaustively cover project comunications like PMBOK (2004) so it is not necessary to create further environments for reflecting on projects outside the context of projects. However, it is possible that these comunications frameworks do not integrate or embed tools to capture knowledge from projects and they hence they need to be amended to suit through integrating oportunities to reflect on and share experiences. As one interview respondent correctly put it, "record reflections to all correspondence so that you capture the spirit of the project"

A key finding which was highlighted in the interview which was not initially identified in the literature review was the impact of geographic culture on knowledge sharing. The interviews highlighted that in certain geographic cultures, knowledge is power and this limits how much knowledge is shared by knowledge workers in these cultures as compared to other geographic culture which openly and freely share what they know even though both cultures belong to the same multi-national organisation. This implies that research on national culture by Minkov and Hofstede (2011) also has an impact on knowledge management in project-based firms and that there is need for further research on how much national culture affects knowledge management in project based firms.

5.2.3. Social Capital + Inter-Firm Networks + Collaboration

Table 10 - Comparison of Findings: Social Capital, Inter-firm Networks and Collaboration

Findings in Research Interview	Findings in Literature Review
creates bond and relationship infrastructure to share knowledge. Stick together to share more. Enhanced trust (6) and openness are ideal for knowledge transfer. Social barriers mean less sharing. No glue means no knowledge sharing (6)	Social capital improves the openness between partners and this in turn encourages interaction and coordination at reduced costs, which results in channeling and sharing knowledge between firms.
Understanding communicates intent and boosts knowledge extracting. Its all about project team members' personality. It helps to know strengths weaknesses, to respect others job and to have team members easy to be work with (6)	Close relationships are necessary for knowledge transfer because strong ties promote in-depth communication and enhance share feelings, emotions, collaborative experiences and obtaining knowledge and understanding processes.
You need to constantly review relationships with performance appraisals so you don't take them for granted.	
Working with the same people enhances brand signature (2)	
	Experience in collaboration with other firms enables a firm to be more effective and efficient in knowledge transfer
Knowing who to call is better than knowing the answer. It's also important to know how to articulate the question. (2)	The most efficient way for firms to absorb + acquire knowledge is through direct communication with partners.
	Inter-firm relationships help firms acquire large amounts of useful and valuable knowledge and to recombine current stock of knowledge and create new knowledge.
You need quality and specialised people to absorb + acquire better quality knowledge. (2)	Interactions with different + diverse individuals increase the organizational capability for creating knowledge + helps apply different knowledge structures + multifaceted mental models.

The literature review and the interviews both confirm that social capital, firm interactions and collaboration creates a social infrastructure framework which encourages trust and interaction and coordination at reduced costs (Walker and Christenson, 2005). As one interview respondent said, "social capital is the glue for knowledge sharing". The interviews and literature review also both confirm that ties from closer relationships promote deeper comunication and understanding which enhances better transfer of knowledge. The literature review and the interviews also both confirmed that its more efficient to share knowledge through direct comunication with partners because knowing who to call and knowing how to ask the question is more important than knowing the answer (Cavusgil, Calantone and Zhao, 2003). Finally, the literature review and the interviews both confirm that specialised and more knowledgeable people with different and diverse knowledge structures increase ability to reposit knowledge and hence encourage collaboration with firms that have different and complementary skills (Zarraga-Orbety and De Saa-Preez, 2006).

The literature review highlights two findings which are not supported by the interviews. The literature review highlights that experience in collaboration with other firms increases effectiveness and

effeciency in knowledge transfer. The literature review also highlights that inter-firm relationships help firms acquire large amounts of knowledge and recombine that knowledge to create new knowledge (Mu, Peng and Love, 2008). On this surface, it would make sense for interviews to confirm this because projects are unique and once-off operations and therefore project based firms should benefit the most from the resulting increase in inter-firm relationship. However, interview responses elselwhere in this research suggest that knowledge in project-based environments is not about quantity but rather about quality. It was highlighted elsewhere in the literature review (Ray, 2008) that knowledge quantity does not necessarily guarantee quality hence the need to prune information, and the interviews have also emphasised the need to evaluate and appraise inter-firm relationships for quality which suggest that the length of the relationship alone does not guarantee quality.

The interviews highlight two findings that are not captured by the literature review. The interviews highlight that the benefits of inter-firm relationships must not be taken for granted but must be constantly evaluated through performance appraisals. This could probably be done through a similar process to an organisation's human resource appraisal but integrated and embedded in project management processes like project post-mortem audits. The other finding that interviews highlight which is not captured by the literature review is that another benefit of sharing knowledge through working with the same people is that it enhances an organisation's brand and signature. Compliance with brand should also not be taken for granted but should be monitored throughout a project. One possible way to do this would be through quality control of vertical integration of supply chain management of project team. This would possibly include centralisation and standardisation of all specification documents issued to vendors through a web portal which clearly communicates the intent of the brand and how that should be translated into the project.



Figure 7 - Comparison Overlay of Interview + Literature Review Findings for Proposition 1

5.2.4. Conclusion to Research Proposition 1

In conclusion, literature reviews and research interviews confirmed the dynamic and unique unique value of sourcing knowledge through dialogue, the value of repositories in sourcing knowledge from repositories, the use of website portals to expand knowledge networks, the need to align knowledge to align itself to a big movement, and the value of knowledge in informing and updating knowledge

workers of trends, breakthroughs and innovations. Both the literature review and interviews also confirmed that people and culture determine the success of knowledge management initiaives, that organisational culture dictates the type of knowledge that an organisation reposits and that the values and brand and philosophy dictate the knowledge shared. and that fostering a sociable environment builds relationships and this encourages knowledge sharing. The literature reviews and interviews also both confirmed that relationships reduce interaction and knowledge costs, promote deeper comunication to enhance knowledge flow and that diversity in workers improved the quality of knowledge accumulated.

Research interviews highlighted findings which were not originally exposed in the literature review. These include the value of knowledge from shared experience being more practical and detailed and the idea of further subdividing an organisation's knowledge repository into centres of Excellence and Comunities of Practice for every industry that the organisation is involved in. Another finding in research interviews not exposed in literature review is the impact of geographic culture on knowledge sharing. Another finding in interviews not captured by the literature review is that the benefits of relationships must not be taken for granted but must be constantly evaluated using performance appraisals, and how sharing knowledge between firms enhances an organisation's brand and signature.

5.3. Discussion of Interview for Research Proposition 2

Project based firms optimize their knowledge resources using

- Codification, Knowledge Sharing and Knowledge Transfer
- Classification, Indexing and Categorization
- Knowledge Workers and Using Information Systems

5.3.1. Codification, Knowledge Sharing and Knowledge Transfer

Table 11 - Comparison of Findings: Codification, Knowledge Sharing and Knowledge Transfer

Findings in Research Interview	Findings in Literature Review
Codification links bundles of information together to get better grip of what we know	codification is the primary vehicle for packaging knowledge into formats that facilitate knowledge transfer and flow around or within organisations
Needs management enforcing of drawing and document standards through office manual, processes guidelines and indexes. List every process like recipes which become checklists because project management very methodical.	Firms benefit from encoding of organizational knowledge in formulas, codes, expert systems, spec sheets, reports, memos, policies and embedding knowledge in physical objects, such as prototypes or technologies and courses.
Use of discussion rooms, collaboration forums to monitor knowledge accumulation, informal talks, social events to share experiences, consultant workshop and brainstorm sessions and internal directories of people in hierarchy level	
Knowledge sharing shapes structures process + production and helps quality control + time effeciency more than building knowledge. Also helps new users accumulate knowledge	Knowledge sharing enhance innovation performance, reduces redundant learning efforts, and generates efficiencies that provides a business with competitive advantage.
	Employees who feel pleasure in sharing knowledge and helping others are motivated by competence and confidence to donate and collect knowledge with colleagues
Meetings and coordination allow interaction and feedback and debate which has effect of dynamically molding knowledge. Integrate social informal knowledge sharing into formal work time and workshop our projects to boost internal knowledge. Also integrate lots of in-house training.	Processes like meetings, organized brainstorm sessions and in-house training with an emphasis on observation and being critical contribute to effective knowledge sharing.

Both literature review and interviews confirmed that codification helps to bundle knowledge into packaged formats which facilitate knowledge transfer and flow (Schulz and Jobe, 2000). Both literature review and interviews also confirm the need for strict formating and policing of information and documentation to standardise information and hence create uniform document standards which allow for channelling information into knowledge (Donate and Guadamillas, 2010). Both literature review and interviews also confirm that codification, knowledge sharing and knowledge transfer is really more about efficiency in process and reducing redundancy through streamlining knowledge flow to give project based firms a competitive advantage (Schulz and Jobe, 2000). Literature review and interviews also confirm the need for meetings, organised brainstorm sessions and in-house training for effective knowledge sharing.

The literature review highlights that knowledge sharing is driven by employees who feel pleasure in sharing and are motivated by a sense of competence and confidence in knowledge sharing (Lin, 2007). This finding is not confirmed in the interviews. A possible explanation for this is that knowledge in a project based firm is not just shared just for the sake of growing the firm's knowledge repository but knowledge is rather shared on a need-to-know basis to solve a specific problem or meet a particular challenge so the priority is in procuring the tacit knowledge of understanding how a task is perfomed instead of focusing on the explicit knowledge of building a repository. This was supported by one respondent who recommended "creating rationales for everything and explaining the rationale and thinking behind the process or action - the key is using software productively – its important to teach principles before teaching software."

The interviews highlight a finding which was not initially pointed out in the literature review. The interviews recommend the use of internal directories of communities of practice, discussion rooms, collaboration forums and informal social events. Interviewees further suggested building an online hierarchal directory of contact people based on level of seniority so as to improve networking as a source of knowledge sharing. This can be achieved through designing customised online social media websites for projects and integrating these with online forums.

5.3.2. Classification, Indexing and Categorization

Both literature review and interviews confirmed that a classification scheme is critical in making knowledge accessible so that organisations can manipulate what they know to create new knowledge and to become more innovative and to benchmark knowledge areas that need improvement (Delen and Al-Hawamdeh, 2009). Both interviews and literature reviews also confirm that tagging knowledge into its appropriate class is a powerful way of indexing knowledge so that it is easier to find during a search (Laudon and Laudon, 2010). Both literature reviews and interviews also confirmed that classification schemes need training and codes to help decodify the knowledge so that it is easier to intepret and understand and use (Hall, 2006).

The literature review highlights the difficulties of removing the specialties of a project's knowledge and generalising it so that the valuable knowledge obtained can be shared (Taminiau Smit and de Lange, 2009). This finding is not identified in the interviews. A possible explanation for this is that knowledge

from projects is best stored in its context because there is a need to understand how the circumstances affected certain decisions and hence shaped knowledge in a certain way. This is supported by interview respondents who embed their knowledge in their process and workflow and other interview respondents specifically quoted, “store all knowledge in original format so we don’t lose context of knowledge.” Another interview respondent said, “we store knowledge in context so it is easier to understand and easier to access it roots.” Therefore knowledge in project based firms does not necessarily need to be generalised because some project-based firms prefer to keep knowledge rooted and embedded to its context.

Table 12 - Comparison of Findings: Classification, Indexing and Categorisation

Findings in Research Interview	Findings in Literature Review
Great classification is backbone to knowledge repositories that help deliver projects. Classifying knowledge manipulates what we know to create new knowledge and makes firm more innovative. Classifying knowledge identifies and benchmarks specific knowledge areas which need to be improved	Key problem in managing knowledge is the creating an appropriate classification scheme, or taxonomy, to organize information into meaningful categories so that it can be easily accessed.
Tagging - don’t put knowledge into index but rather put index onto knowledge. Quite powerful way of indexing knowledge.	Once the categories for classifying knowledge have been created, each knowledge object needs to be "tagged" to its appropriate class, so that it can be easily retrieved.
Mandate staff to know structure + how to access knowledge + hundreds of knowledge courses ease classification gets knowledge onto fingertips	Define codes to interpret and “decodify” knowledge. Codes make it easier to diffuse knowledge to communities who can read the codes. Context gap between sender + receiver only broken by some codebook to understand the knowledge
	Difficulties reside in taking out the specialties of a project’s knowledge and generalizing it in such a way as to be able to share the valuable knowledge obtained
Our process and workflow is embedded with classification and indexing in its methodology. Can see differences instantly. Our work already indexed through highliting comments and logical sequence and structure of convention.	
Must be simple and easy to use – the simpler the better – must not be too complex. You must only go through a maximum of 4 folders to access information – not 10 folders.	
Very strict and particular because we use project archive structure as main way to store knowledge in context so easier to understand and easier to access. Classifying knowledge is more about time management than process management so quick access is key to knowledge management.	

The interviews also highlighted three findings which were not initially identified by the literature review. Interview respondents first identified that classification schemes were better at indexing knowledge when they were designed to be simple and not too complex with a maximum of four stages of searching to access knowledge. This suggests that indexing for knowledge management is also subject to principles of interface design to maximise the psychology of human nature and how humans can best interact with information and machines. Secondly, interviews identified the benefits of embedding knowledge management in classification and noting experiences in their procesess,

methodology and processes simultaneously as they executed projects. This is more an exercise in operations management within a project based firm and would probably include operations planning including job design and process flow design. A third finding from interviews not identified by the literature review is how project based firms double up their project repositories as knowledge management repositories and hence emphasise on strictly following classification standards wthin projects. They identify the benefits of this as that knowledge stored in its context is easier for them to understand and they regard quick and easy access to knowledge as a key tool of knowledge management. The best way to enhance this asset would be to design the classification scheme into the company's information systems structure so that the rigidity can shape and dictate how the project-based firm works and stores knowledge.

5.3.3. Knowledge Workers and Information Systems

Table 13 - Comparison of Findings: Knowledge Workers and Using Information Systems

Findings in Research Interview	Findings in Literature Review
Appreciate knowledge workers for their knowledge and respect and acknowledge and applaud contribution. Invest in people and give them shares to retain them	Firms must identify knowledge workers, take care of them, develop their special competences and educate them through talent management initiatives.
Knowledge Workers proactively learn from exposure to projects and observation. (5) Experience very important. The longer someone in firm the more knowledge they absorb. Need interested as main motivation in building knowledge.	Employee's knowledge and individual memory developed through observations, experiences, actions, skills of how to do things and ability to absorb knowledge
Formal protocols, processes and guidelines must force workers to write what they know in libraries and regularly tested. Workers must also learn to ask the right questions, storytelling + sharing mistakes + lessons.	Knowledge workers must tap and harvest tacit knowledge using interview sessions, narrations or story telling and knowledge exchange protocols or action protocols.
All key irreplaceable people have junior under them who does bulk of work to ensure knowledge transfer + continuity. Also maximise the knowledge of very talented people to be shared with firm before they leave. (2)	
Explain rationale + thinking behind every process + teach principles (2). Train + emphasise productive use of software especially to top management and instantly enforce what you have learnt (9). Get suppliers to come discuss products (2)	
Clients now demand and enforce standardising systems across project teams (2) to ensure collaboration and limit people working as islands (2) to boost efficiency in knowledge flow. Incompatibility hinders flow of information (4) and knowledge and helps avoid losing information.	Organisations standardise systems to improve and simplify knowledge resource management. Standardising systems allows extracting and exchange of information, patterns and trends which helps to guide decision making and creates valuable knowledge for an organisation
use databases and knowledge management systems and classification to store what you learn (3)	using databases as a knowledge source recognises and stores information patterns, which reduces information overflow and makes the knowledge generated easier to use and more effective for the knowledge worker

Both the literature review and interviews confirm the value of appreciating and applauding knowledge workers, rewarding them for their worth and nurturing their talents (Kokavcova and Mala, 2009). Both literature reviews and interviews also recommend exposure to tasks as the primary method of

accumulating knowledge for knowledge workers and they identify protocols, interviews and sharing mistakes as vital to tapping and harvesting knowledge (Delen and Al-Hawamdeh, 2009). Both literature reviews and interviews confirm that standardising information systems improves and simplifies knowledge resource management and creates valuable knowledge for the organisation (Ray, 2008). In fact, interviewees claim that clients now demand information system standards and sometimes even design the information system collaboration system so as to optimise knowledge and value extracted from knowledge workers. Interviews and literature review also both confirm the need to use database as a knowledge source to store patterns of information rather than information itself, which makes the knowledge generated more effective for the knowledge worker (Gammelgaard and Ritter, 2005).

The interviews highlight three findings which are not identified in the literature review. The interview recomends all key irreplaceable people to have junior people under them to ensure knowledge transfer and continuity and to maximise the knowledge of talented people in the firm. The second finding from interview that is not identified by the literature review is to create rationales and understanding for every action. Here interviews emphasise the value of teaching principles before teaching process and criticise lack of training of knowledge workers especially in top management. Both findings can possibly be addressed through human resource programs like talent management and succession planning. Both findings can also be addressed by training although every extensive training program needs to be followed through by testing to check for quality and consistency in what was learnt.

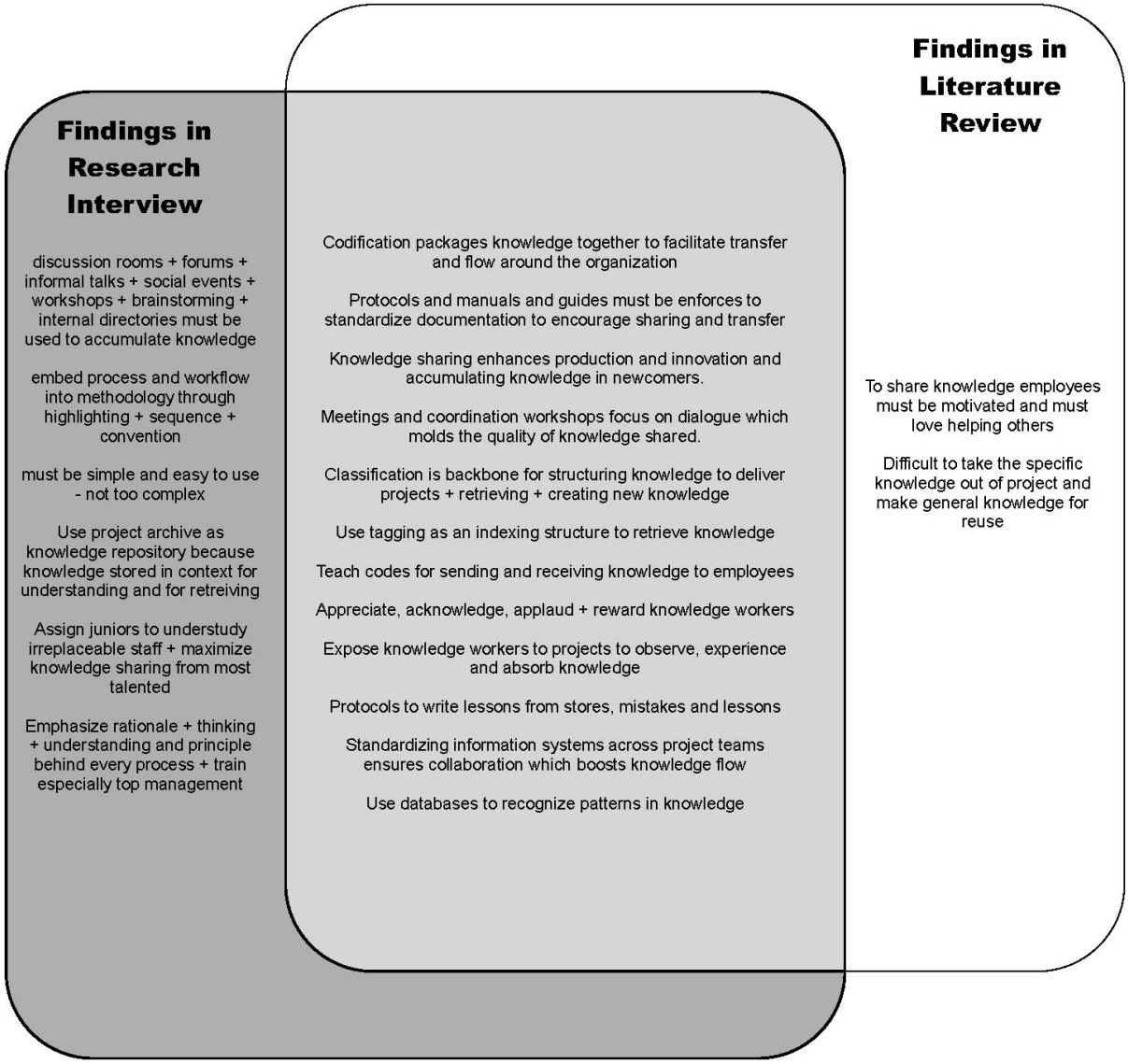


Figure 8 - Comparison Overlay of Interview + Literature Review Findings for Proposition 2

5.3.4. Conclusion to Research Proposition 2

Both literature review and interviews confirmed the value of bundling knowledge into packaged formats to facilitate knowledge transfer and flow, the need for strict formating and policing of information and documentation to standardise information and to channel knowledge, that optimising knowledge is more about efficiency and reducing redundancy through streamlining knowledge flow, that meetings, brainstorming and in-house training enhance knowledge sharing.

Both literature review and interviews confirmed that classification makes knowledge accessible for manipulation and innovative and improvement, that tagging knowledge improves retreival and that codes make it is easier to intepret, understand and use knowledge.

Both the literature review and interviews recommend acknowledging knowledge workers, recommend exposure as the primary method of accumulating knowledge, identify protocols, interviews and sharing mistakes as vital to tapping and harvesting knowledge, confirm that standardising information systems improves and simplifies knowledge resource management.

The interviews highlight findings which were not initially pointed out in the literature review. The interviews recommend the use of internal directories and interactive tools as a source of knowledge sharing, the use of classification schemes to indexing knowledge, the benefits of embedding knowledge management in procesess and methodology and how project based firms double up their project repositories as knowledge management repositories and hence emphasise on strictly following classification standards wthin projects.

The interview also recomends all key irreplaceable people to have junior people under them to ensure knowledge transfer and continuity and to maximise the knowledge of talented people in the firm, creating rationales and understanding for every action to teach principles before teaching process.

5.4. Discussion of Interview for Research Proposition 3

Project based firms face the knowledge management challenges of

- Team Disbanding and Lack of Project Repository
- Post-Mortem Audits and Not Admitting Mistakes and Failures

5.4.1. Team Disbanding + Lack of Project Repository

Table 14 - Comparison of Findings: Team Disbanding and Lack of Project Repository

Findings in Research Interviews	Findings in Literature Review
Handover document with reports by consultants, drawings, before and after pictures. Formal closeout document and closeout filing signed by everybody and legally given to client. Client is not going to pay us if report is poor quality.	When people from different contributing organizations disband at end of project – their experience and knowledge dissipates because it is rarely recorded or available after project is complete. Need for end of project documentation.
There needs to be contact info of everyone who worked on a project at the end	It's difficult to find out who worked on a project, what tasks they were responsible for, and where these employees are working when a project is finished.
Store all knowledge in original format so context of knowledge is not lost. Storytelling is critical. Capture spirit of project by documenting as much correspondence as possible and publish into book.	
Online repositories but expensive. Storing easy but retrieving is the challenge. Focus on paper-like retrieval systems because these are best format to access.	Project information is rarely captured, retained, or indexed so that people external to the project can easily retrieve and apply the knowledge to future tasks.
Gather knowledge constantly as project goes along so only few remaining files to collect when project ends (4). Dedicate person to archive + retrieve project knowledge. Project leader constantly checks value + quality of knowledge	
Quantify the knowledge value for project end and use this to validate building project closeout into budget as time and cost item	

Both the literature review and interviews confirm the need for recording project closeout documentation as a formal source of both project information and knowledge (Disterer, 2002). Literature review and interviews also both confirm the need to keep a project directory of everyone who worked on the project and which tasks they were responsible for (Walker and Christenson, 2005). This will probably best be maintained and regularly updated by the product manager or the program manager and will be used for maintenance or updating of the product generated by the project. Both the literature review and the interviews confirm the need for retaining the project information and knowledge in a centralized online repository so that knowledge is easier to access for the whole external project team after the project is long finished (Disterer, 2002).

The interviews further identify three findings that are not highlighted in the literature review. The interviews first recommend storing knowledge in its original format so as not to lose the context of

knowledge and further promotes the role of storytelling and capturing the spirit of the project in documenting knowledge. One possible way of doing this is to hire a researcher or curator to collect all information about a project so that it can be captured into collective and shared experiences. The interviews also strongly recommend the gathering of knowledge as the project goes along so as to ease the burden of gathering information and knowledge at project closeout. Interviewees suggest possible ways of implementing this to include a dedicated person who archives and retrieves project knowledge and having the project leader to check the value and quality of knowledge. Interviews also recommend quantifying the value of repositing knowledge at project end so as to use this to validate intergrating a project closeout phase into the budget as a time and cost item in the project scope, and this was not initially identified in the literature review.

5.4.2. Post Mortem Audits + Not Admitting Mistakes and Failures

Table 15 - Comparison of Findings: Post-Mortem Audits and Not Admitting Mistakes and Failures

Findings in Research Interview	Findings in Literature Review
Have weekly meetings to discuss progress + grievances and address mistakes and errors. Allow time to expose common problems. Do project audits as you go along not just at end.	Strictly enforced rules that a project should not the regarded as over until the knowledge gained is properly managed especially during audits
Post-mortem audits facilitated by outsider. People must only participate only at expert level. Highly technical interviews	Post-mortem at the end of the project by a qualified facilitator not previously involved in the project
	Capturing knowledge and experiences at end of project pressed by time and budget restrictions and dropped because staff needed for other following projects as soon as possible
Create right environment to admit mistakes and to criticise quality of work with clear intent of learning	There is value in analyzing failures and mistakes but lack of an open and constructive atmosphere to articulate errors
Audits attract criticism to ourselves and feel awkward so we avoid them altogether	A football team can improve performance by uncomfortably watching films of games it lost and learning from mistakes
Consultants have own audit and client and end user have own audit. As internal consultants we openly review ourselves but client review board is more about defending actions	
Conduct post occupancy market research to see if customer happy with our product linked to maintenance, also audit products not just processes	
People who check are always at higher level than people who implement	
Focus in understanding process and methodology of delivering projects and that's what we audit. Never really person that fails but rather system that fails. Standardise process so its easier to find method flaws. Never one person but always interlink in group of people	
There is a fear of rekindling old wounds and damaging relationships with key knowledge workers who may have messed up on one project but are generally very reliable.	

In general the results of the interviews confirmed the findings that were highlighted in the literature review. Both the interviews and literature review confirmed that strict protocols should be set in place

to ensure that knowledge gained is captured as the project progresses not just at the end of the project (Ajmal, Kekale and Takala, 2009). Both the interviews also confirmed that post mortem a trained and professional facilitator who was not previously involved on the project should conduct audits. Both the interviews and literature review also confirmed that there is need to create the right environment to admit mistakes and record the lessons learnt as knowledge and that post-mortem audits are awkward and uncomfortable but are essential in learning from mistakes and hence building a knowledge base (Disterer, 2002).

The only finding that was highlighted in the literature review which was not reflected in the interviews was the fact that capturing knowledge and experiences at end of a project is pressed by time and budget restrictions and must be dropped because staff are needed for other following projects as soon as possible (Ajmal, Kekale and Takala, 2009). A possible reason why interviews did not highlight this challenge is because project based firms regularly carry out audits as the project goes along as noted elsewhere in interviews hence there is no need to capture knowledge and experiences at the end of the projects when staff are needed elsewhere.

The interviews highlighted some challenges that were not addressed by the literature review. Two challenges identified in the interview that were not addressed in the literature review are having higher qualified people to check implementation and the need for auditing method flaws in standardized processes. This implies that project audits are very process-oriented and they therefore have potential to benefit from knowledge management tools and methodologies just like and other tasks in project based firms.

Another two challenges addressed in interviews but not identified in the literature review are the fear of damaging relationships with key staff during project audits and the need to separate internal consultant audits from client audits. This suggests that knowledge management is as much a people management skill as it is an information management skill.

A final finding from interviews which was not identified in the literature review was the need not for just project audits but the need for product audits linked to product maintenance programs to assess if the customer was satisfied and to investigate if there is any way the product can be improved in the next project. This will also benefit the project team in not repeating the same mistakes in their projects and hence focus on continuous improvement programs like business process reengineering and six sigma.

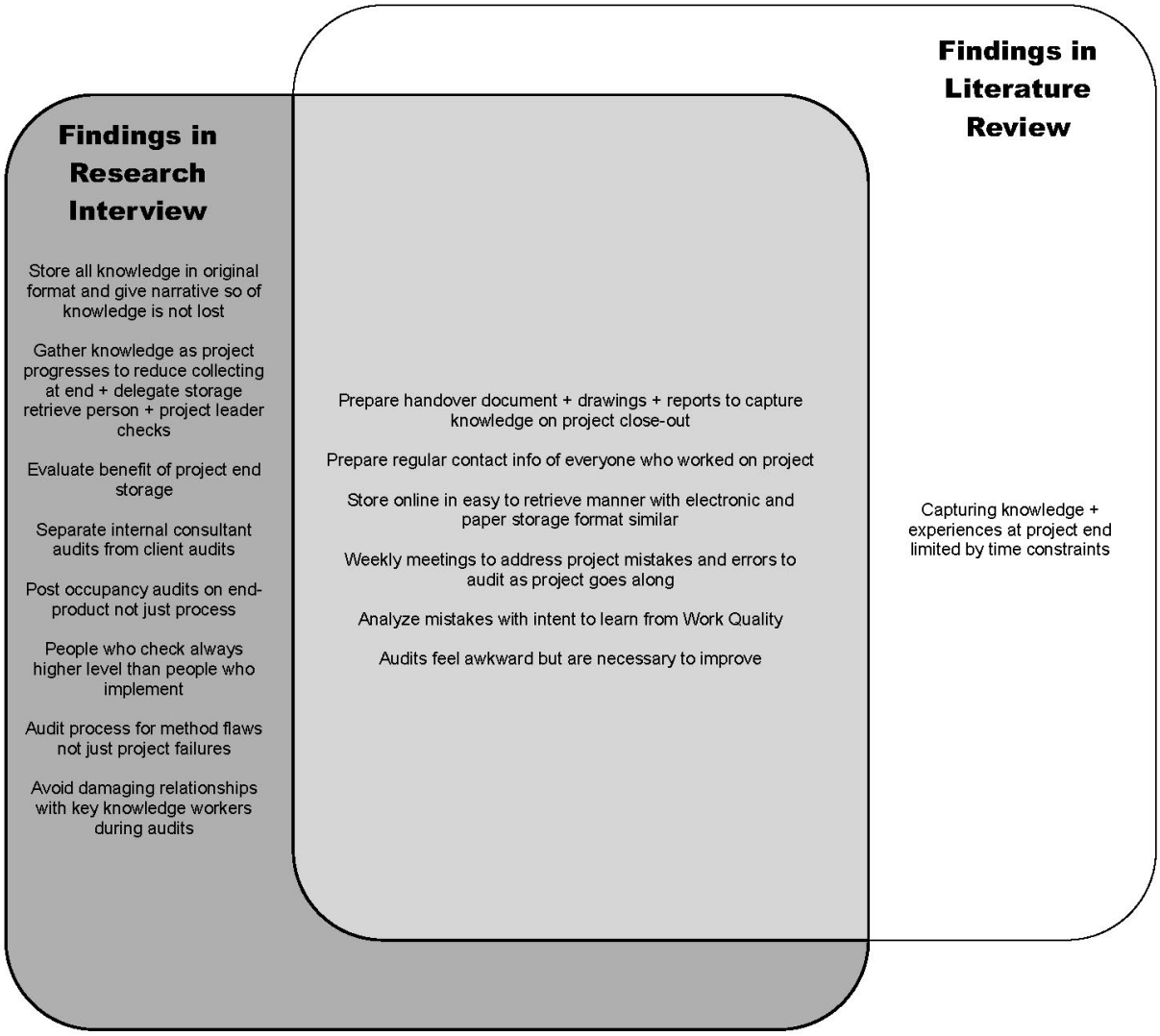


Figure 9 - Comparison Overlay of Interview + Literature Review Findings for Proposition 3

5.4.3. Conclusion to Research Proposition 3

Both the interviews and literature review confirmed the need for strict protocols to ensure knowledge is captured progressively, a professional external facilitator conducts post mortem audits, that a conducive environment is needed and that post-mortem audits are awkward, uncomfortable but essential in building knowledge. Knowledge and literature reviews also both confirmed the need for project closeout, the need to keep a project directory of team members and their roles and the need for retaining the project knowledge in a centralized online repository.

The interviews highlight findings which were not initially pointed out in the literature review. The interviews recommend higher qualified people to check implementation, the need for auditing method flaws in standardized processes, the fear of damaging relationships with key staff during project audits and the need to separate internal consultant audits from client audits. A final finding from interviews not identified in the literature review was the need not for just project audits but the need for product audits.

5.5. Conclusion on Discussion of Results

The purpose of this chapter was to interpret the findings of the research interview in the context of the findings in the literature review. Proposition 1 relates to how project based firms source their knowledge using Knowledge Networks, Communities of Practice, Organizational Culture, Social Networks, Firm Interactions and Collaboration. Proposition 2 relates to how project based firms optimize their knowledge resources using Codification, Knowledge Sharing and Knowledge Transfer, Classification, Indexing and Categorization, Knowledge Workers and Using Information Systems. Proposition 3 relates to how project based firms face the knowledge management challenges of team disbanding and lack of project repository and post-mortem audits and not admitting mistakes and failures. The findings from the literature review were compared and contrasted to the findings from the research interview and comments were drawn on the responses. When comparing findings from the interviews to the literature, the interviews confirmed most of the findings in the literature review. In cases where the interviews could not account for the findings in the literature review, possible explanations and comments were provided. There were also cases where the interviews revealed findings that were not revealed in the literature review and these were also identified.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

This final chapter brings together the conclusions of the study. The findings and the literature review are discussed in the context of the purpose and problem statement of the study. Following the conclusions of the study are recommendations to project based firms in light of the outcomes of the research undertaken. The chapter closes with suggestions for further research in areas that may be of interest and relevance to further study.

6.2. Conclusions

6.2.1. Conclusions on Research Proposition 1

6.2.1.1. Research Proposition 1

Project based firms source their knowledge using

- Knowledge Networks, Communities of Practice,
- Organizational Culture
- Social Networks, Inter-firm Networks and Collaboration

6.2.1.2. Conclusions

There is unique value in sourcing knowledge from people through knowledge networks and comunities of practice because of the dynamic nature of dialogue, which has a benefit of chanelling and directing the knowledge you want to extract.

Repositories built from knowledge networks and CoPs avoid unecessary work through reusing what is known and what has been done before. Interviews and literature review also confirm that website

portals are useful in expanding knowledge networks and with their use, extracting knowledge becomes a matter of asking the right questions.

There is need for a big movement or topic to follow with specific values and particular problem or goal to address so as to align knowledge extraction and decoding.

Knowledge from knowledge networks and communities of practice informs knowledge workers of trends and breakthroughs and innovations and through stimulating them to do things differently, it fosters them to be innovative and evokes them to search for new ideas, techniques and decision making behaviour.

People and culture are the key factors that determine the success or failure of knowledge management initiaives, working with substandard people results in a problem culture.

Culture dictates the type of knowledge that an organisation reposits and that the values and brand and philosophy of the company dictate the knowledge shared.

Fostering a sociable environment builds relationships and this encourages knowledge sharing. Two companies interviewed actually went to the extent of adopting project consultants into the organisation's culture before working with them.

Social capital, inter-firm networks and collaboration creates a social infrastructure framework which encourages trust and interaction and coordination at reduced costs. As one interview respondent said, "social capital is the glue for knowledge sharing".

Ties from closer relationships promote deeper comunication and understanding which enhances better transfer of knowledge.

Its more efficient to share knowledge through direct comunication with partners because knowing who to call and knowing how to ask the question is more important than knowing the answer.

Specialised and more knowledgeable people with different and diverse knowledge structures increase ability to reposit knowledge and hence encourage collaboration with firms that have different and complementary skills.

6.1.2.3. Relating Conclusions to Problem Statement and Proposition 1

The first sub-problem was to analyze how South African project based firms source knowledge from projects they undertake. After an extensive literature review, Proposition 1 suggested the project based firms source their knowledge using Knowledge Networks, Communities of Practice, Organizational Culture, Social Networks, Firm interactions, Networks and Collaboration. After confirming these suggestions with findings in the research interview, it can be concluded that project based firms can source project knowledge by emphasizing on the dynamic and unique unique value of dialogue, the value of improving quality of knowledge repositories, the use of website portals to expand knowledge networks, the aligning knowledge sourcing to a big knowledge movement, and the value of knowledge in informing and updating knowledge workers of trends, breakthroughs and innovations. Project based firms must also acknowledge that people and culture determine the success of knowledge management initiatives, that organisational culture dictates the type of knowledge that an organisation reposits and that the values and brand and philosophy dictate the knowledge shared, and that fostering a sociable environment builds relationships and this encourages knowledge sharing. Project based firms must also emphasise that relationships reduce interaction costs and knowledge costs, promote deeper communication to enhance knowledge flow and that diversity in workers improved the quality of knowledge accumulated. This concludes how project based firms can source knowledge from projects they undertake.

6.2.2. Conclusions on Research Proposition 2

6.2.2.1. Proposition 2

Project based firms optimize their knowledge resources using

- Codification, Knowledge Sharing and Knowledge Transfer
- Classification, Indexing and Categorization
- Knowledge Workers and Using Information Systems

6.2.2.2. Conclusions

Codification helps to bundle knowledge into packaged formats which facilitate knowledge transfer and flow. Codification, knowledge sharing and knowledge transfer is really more about efficiency in process and reducing redundancy through streamlining knowledge flow to give project based firms a competitive advantage.

There is need for strict formating and policing of information and documentation to standardise information and hence create uniform document standards which allow for channelling information into knowledge.

There is need for meetings, organised brainstorm sessions and in-house training for effective knowledge sharing.

A classification scheme is critical in making knowledge accessible so thay organisations can manipulate what they know to create new knowledge and become more innovative and to benchmark knowledge areas that need improvement.

Tagging knowledge into its appropriate class is a powerful way of indexing knowledge so that it is easier to find during a search.

Classification schemes need training and codes to help decodify the knowledge so that it is easier to intepret and understand and use.

There is value in appreciating and applauding knowledge workers, rewarding them for their worth and nurturing their talents.

Exposure to tasks is the primary method of accumulating knowledge for knowledge workers and they identify protocols, interviews and sharing mistakes as vital to tapping and harvesting knowledge.

Standardising information systems improves and simplifies knowledge resource management and creates valuable knowledge for the organisation. In fact, interviewees claim that clients now demand information system standards and sometimes even design the information system collaboration so as to optimise knowledge and value extracted from knowledge workers.

There is need to use database as a knowledge source to store patterns of information rather than information itself, which makes the knowledge generated more effective for the knowledge worker.

6.2.2.3. Relating Conclusions to Problem Statement and Proposition 2

The second sub-problem was to analyze how South African project based firms optimize their knowledge resources for projects they undertake. After an extensive literature review, Proposition 2 suggested that project based firms optimize their knowledge resources using Codification, Knowledge Sharing and Knowledge Transfer, Classification, Indexing and Categorization, Knowledge Workers and Using Information Systems. After confirming these suggestions with findings in the research interview, it can be concluded that project based firms can optimize their knowledge resources by emphasizing the value of bundling knowledge into packaged formats to facilitate knowledge transfer and flow, by strict formating and policing of information and documentation to standardise information and to channel knowledge, by meetings, brainstorming and in-house training to enhance knowledge sharing. Project-based firms can also optimise their knowledge resources by using classification to make knowledge accessible for manipulation and innovation and improvement, by tagging knowledge to improve retreival and using codes to make it is easier to intepret, understand and use knowledge.
Project based firms can also optimise their knowledge resources by acknowledging knowledge workers, by using exposure as the primary method of accumulating knowledge, by recognising that protocols, interviews and sharing mistakes are vital to tapping and harvesting knowledge and by standardising information systems to improve and simplify knowledge resource management. This concludes how project based firms can optimize their knowledge resources for projects they undertake.

6.2.3. Conclusions on Research Proposition 3

6.2.3.1. Proposition 3

Project based firms face the knowledge management challenges of

- Team Disbanding and Lack of Project Repository
- Post-Mortem Audits and Not Admitting Mistakes and Failures

6.2.3.2. Conclusions

There is need for strict protocols to be set in place to ensure that knowledge gained is captured as the project progresses not just at the end of the project.

There is need for post mortem audits to be conducted by a trained and professional facilitator who was not previously involved on the project.

There is need to create the right environment to admit mistakes and record the lessons learnt as knowledge and that post-mortem audits are awkward and uncomfortable but are essential in learning from mistakes and hence building a knowledge base.

There is need for recording project closeout documentation as a formal source of both project information and knowledge.

There is need to keep a project directory of everyone who worked on the project and which tasks they were responsible for. This will probably best be maintained and regularly updated by the product manager or the program manager and will be used for maintenance or updating of the product generated by the project.

There is need for retaining the project information and knowledge in a centralized online repository so that knowledge is easier to access for the whole external project team after the project is long finished.

6.2.3.3. Relating Conclusions to Problem Statement and Proposition 3

The third sub-problem was to evaluate the challenges that South African project based firms face in managing project knowledge. After an extensive literature review, Proposition 3 identified that project based firms face the knowledge management challenges of team disbanding at project end, lack of a project repository for consolidated knowledge storage, insufficient post-mortem audits and not admitting mistakes and failures. After confirming these suggestions with findings in the research interview, it can be concluded that project based firms can meet the challenges of managing project knowledge by emphasizing the need for strict protocols to ensure knowledge is captured

progressively, a professional external facilitator conducting post mortem audits, a conducive environment for sharing failures and mistakes, the need for project closeout, the need to keep a project directory of team members and their roles and the need for retaining the project knowledge in a centralized online repository. This concludes how project based firms can meet the challenges of managing project knowledge.

Table 16 - Table of Conclusions

How PBFs Source Project Knowledge	How PBFs Optimize Knowledge for Projects	Meeting Project Knowledge Challenges in PBFs
the dynamic and unique unique value of dialogue	bundling knowledge into packaged formats to facilitate knowledge transfer and flow	Strict protocols to ensure knowledge is captured progressively
value of improving quality of knowledge repositories	strict formating and policing of information and documentation to standardise information and to channel knowledge	A professional external facilitator conducting post mortem audits
use of website portals to expand knowledge networks	meetings, brainstorming and in-house training to enhance knowledge sharing	A conducive environment for sharing failures and mistakes
aligning knowledge sourcing to a big knowledge movement	using classification to make knowledge accessible for manipulation and innovation and improvement	The need for project closeout
informing and updating knowledge workers of trends, breakthroughs and innovations	tagging knowledge to improve retreival	Keep a project directory of team members and their roles
people and culture determine the success of knowledge management initiaives	using codes to make it is easier to intepret, understand and use knowledge	Retaining the project knowledge in a centralized online repository
organisational culture dictates the type of knowledge that an organisation reposits and that the values and brand and philosophy dictate the knowledge shared	acknowledging knowledge workers	
fostering a sociable environment builds relationships and this encourages knowledge sharing	using exposure as the primary method of accumulating knowledge	
relationships reduce interaction costs and knowledge costs, promote deeper comunication to enhance knowledge flow	protocols, interviews and sharing mistakes are vital to tapping and harvesting knowledge	
that diversity in workers improved the quality of knowledge accumulated	standardising information systems to improve and simplify knowledge resource management	

6.3. Recommendations

6.3.1. Recommendations for Research Proposition 1

Project based firms source their knowledge using

- Knowledge Networks, Communities of Practice,
- Organizational Culture
- Social Networks, Inter-firm Networks and Collaboration

This research recommends extracting knowledge from knowledge networks and communities of practice in preference over other knowledge sources because this knowledge is more detailed and more practical since it is rooted in sharing work experiences direct from project environments.

This research recommends further subdividing an organisation's knowledge repository into Centres of Excellence and Comunities of Practice for every industry that the organisation is involved in. This has the effect of sharpening the knowledge focus of an organisation and diversifying their knowledge base to suit their specialisation focus while still maintaining the goal of building a common knowledge repository. This could be done through delegating knowledge leaders in certain fields and assigneing subject matter experts for consultation on knowledge in specific fields. This could all be integrated and coordinated using website portals on each knowledge field brancing off from a common knowledge management website for the project based firm.

This research recommends that firm interactions must not be taken for granted but must be constantly evaluated through performance appraisals. This could probably be through a similar process to an organisation's human resource performance review system but must be integrated and embedded in project management processes like project post-mortem audits.

This research recommends sharing knowledge through working with the same people so as to enhance an organisation's brand. But this should also not be taken for granted and should be monitored throughout a project. One possible way to do this would be through quality control of vertical integration of supply chain management of project team. This would possibly include centralising and standardisation of all specification documents issued to vendors through a web portal which clearly comunicates the intent of the brand and how that should be translated into the project.

6.3.2. Recommendations for Research Proposition 2

Project-based firms optimize their knowledge resources using

- Codification, Knowledge Sharing and Knowledge Transfer
- Classification, Indexing and Categorization
- Knowledge Workers and Using Information Systems

This research recommends the use internal directories of communities of practice, discussion rooms, collaboration forums and informal social events. This research also recommends building online hierarchy directories of contact people based on level of seniority to improve networking as a source of knowledge sharing. This can be achieved through designing customised online social media websites for projects and integrating these with online forums.

This research recommends that classification schemes are better at indexing knowledge when they are designed to be simple and not too complex with a maximum of four stages of searching to accessing knowledge. This research also recommends using the principles of interface design to maximise the psychology of human nature and how humans can best interact with information and machines.

This research recommends embedding knowledge management in classification and noting experiences in their procesess, methodology and processes simultaneously as projects are executed. This is more an exercise in operations management within a project-based firm and would probably include operations planning including job design and process flow design.

This research recommends that project-based firms double up their project repositories as knowledge repositories and must hence emphasise on strictly following classification standards. This is because knowledge stored in its context is easier to understand and quick and easy access to knowledge is a key tool of knowledge management. The best way to enhance this asset would be to design the classification scheme as seamlessly integrated into the company's information system structure so that the rigidity can shape and dictate how the project-based firm works and stores knowledge.

This research recomends all key irreplaceable people to have junior people under them to ensure knowledge transfer and continuity and to maximise the knowledge of talented people in the firm.

This research recommends creating rationales and understanding for every action with emphasis to the value of teaching principles before teaching process and even greater emphasis to training of knowledge workers especially in top management. Both can possibly be addressed through human resource programs like talent management, succession planning and extensive training programs followed through by testing to check for quality and consistency of learning objectives.

6.3.3. Recommendations for Research Proposition 3

Project based firms face the knowledge management challenges of

- Team Disbanding and Lack of Project Repository
- Post-Mortem Audits and Not Admitting Mistakes and Failures

This research recommends storing knowledge in its original format so as not to lose the context of knowledge and further promotes the role of storytelling and capturing the spirit of the project in documenting knowledge. One possible way of doing this is to hire a researcher or curator to collect all information about a project so that it can be captured into collective and shared experiences.

This research recommends the gathering of knowledge as the project goes along so as to ease the burden of gathering information and knowledge at project closeout. A possible way of implementing this would be to include a dedicated person who archives and retrieves project knowledge and having the project leader to check the value and quality of knowledge.

This research recommends quantifying the value of building a knowledge repository at the end of a project so as to validate the intergartion of a project closeout phase into the budget as a time and cost item in the project scope.

This research recommends having higher qualified people to check implementation and the need for auditing method flaws in standardized processes. This research recommends addressing the fear of damaging relationships with key staff during project audits. This research also recommends the need to separate internal consultant audits from client audits.

This research recommends the need not for just project audits but the need for product audits linked to product maintenance programs to assess if the customer was satisfied and to investigate if there is any way the product can be improved in project based firms' next project.

6.4. Suggestions for Further Research

There is need for further research on the impact of knowledge lost during transfer from data to information to knowledge and how this impacts the quality and quantity of knowledge reposited in project based firms.

This research found that in certain geographic cultures, knowledge is power and this limits how much knowledge is shared by knowledge workers in these cultures as compared to other geographic cultures which openly and freely share what they know even though both geographic cultures belong to the same multi-national organisation. There is need for research on how national geographic culture impacts implementing Knowledge Management in Project Based Firms.

There is need to further investigate the role of information systems in knowledge management of project based firms.

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APPENDIX A: RESEARCH INSTRUMENT

1. Do you consider Knowledge Networks (consulting experts, websites and previous project archives) and Communities of Practice (conferences, online newsletters and sharing of work experiences) to be a useful when sharing source of project knowledge? If so, describe how these are useful.

2. Does Organisational Culture contribute to sourcing knowledge from projects. If so, how does it help?

3. Do you source knowledge from social capital, Firm Interactions and Collaboration? If so, to what extent?

4. Is codification, knowledge transfer and knowledge sharing used to maximum potential for projects in your organisation? If so, how?

5. Does indexing, classification and categorisation help maximise the way you use knowledge in project? If so, how?

6. Does your organisation use the knowledge workers and information systems to extract the maximum possible knowledge? If it does, how?

7. Does the disbanding of project teams at the end of projects and the lack of a common project repository affect how you manage knowledge in your organisation? If so, how does it affect you and how do you address this?

8. Do insufficient project post-mortem audits and difficulties of people admitting their failures and mistakes affect how you manage knowledge in your projects? If so, how does it affect you and how do you address it?