MANAGING SUSTAINABILITY KNOWLEDGE IN THE CANADIAN MINING INDUSTRY

by

Waad Khogali Ali (Honours Bachelor of Science- University of Toronto, Toronto, 2011)

A thesis

presented to Ryerson University

in partial fulfillment of the

Requirements for the degree of

Master of Applied Science

In the program of

Environmental Applied Science and Management

Toronto, Ontario, Canada, 2014

AUTHOR'S DECLARATION FOR ELECTRONIC SUBMISSION OF A THESIS

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I authorize Ryerson University to lend this thesis to other institutions or individuals for the purpose of scholarly research

I further authorize Ryerson University to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

I understand that my thesis may be made electronically available to the public.

MANAGING SUSTAINABILITY KNOWLEDGE IN THE CANADIAN MINING INDUSTRY

MA.Sc. 2014

Waad Khogali Ali

Environmental Applied Science and Management

Ryerson University

Abstract

This study was undertaken in order to identify and discuss KM techniques that are used to manage sustainability knowledge in the Canadian Mining Industry. Semi-structured interviews were conducted with 15 sustainability executives in the Canadian mining industry. The findings show that few mining firms are reaping the full benefits of knowledge management in terms of codifying tacit knowledge, providing employees with the necessary resources to contribute to the organization's knowledge, retaining project knowledge, establishing KM roles and a KM strategy and monitoring the success of KM. The difficulties of managing sustainability knowledge as expressed by the firms interviewed in this study can be overcome by effective implementation of knowledge management. Effective implementation of knowledge management will need to be governed by top management commitment and the ability of the organization to make changes in strategic programs and adopting the necessary behaviors that facilitate KM.

Acknowledgments

I would like to acknowledge the tremendous support I have received during this exciting period of my life. The journey to complete this master's thesis would not have been possible without the support of the following individuals.

Dr. Philip Walsh is a creative, encouraging, motivating, kind and patient supervisor. Throughout my time at Ryerson University, he allowed me to progress from my curious idea to fulfilling my research goals. His guidance throughout my master's thesis has shaped not only this thesis but also my future career as Geologist specializing in knowledge management. I could not have been as successful as I am right now without his help every step of the way. It was a pleasure to study under such an esteemed mentor and supervisor.

I am grateful to Dr. Nick Milton, Knowledge Manager of British Petroleum (BP) in Norway who took the time to review my rough draft interview questions. Dr. Nick Milton who is a Geologist by training, acted as the Knowledge Manager of the BP knowledge management team. This team developed and implemented a process by which the business could make maximum benefit of the knowledge and expertise within the organization. They delivered $260 million in measurable benefit to BP business units through 1988 pilot projects alone.

I am indebted to all the mining Vice-President Sustainability and Vice-President Corporate Social Responsibility who participated in this research study. Without their involvement, completion of this study would not have been possible.

To all my friends who followed my progress and provided constant words of encouragement, I appreciated your support. I am extremely fortunate to have a mother and father who instilled the value of hard work into me. For as long as I can remember, they have always been there for me throughout my life, including my educational endeavors. To all my siblings, Walied, Azza, Rashid, Murwan, Yusra and Wagdi, thank you for all your continued support.

W.K, June, 2014

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

List of Abbreviations

AARs	After Action Reviews
AoM	Association of Management
BDAL	Business Driven Action Learning
CBT	Computer Based Learning Systems
CEO	Chief Executive Officer
CMS	Content Management System
CoP	Community of Practice
CR	Corporate Responsibility
CSR	Corporate Social Responsibility
DSS	Decision Support Systems
ECO	Environmental Commissioner of Ontario
EIR	Extractive Industries Review
EITI	Extractive industries Transparency Initiative
EKD	Enterprise Knowledge Development
ELM	Experimental Learning Model
EPSS	Electronic Performance Support System
ESMAP	Energy Sector Management Assistance Program
FAO	Food and Agriculture Organization
FV	Freight Villages
GDP	Gross Domestic Product
GMI	Global Mining Initiative
GRI	Global Reporting Initiative
HRM	Human Resource Management
ICMM	International Council of Mining and Metals
IDC	International Data Corporation
IICTs	Integrated Information and Communication Technologies
IK	Indigenous Knowledge
IS	Information Systems
ISKM	Integrated System of Knowledge Management

ISO	International Organization for Standardization
IT	Information Technology
KM	Knowledge Management
KMSs	Knowledge Management Systems
MMSD	Mining, Minerals and Sustainable Development
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
OSN	Online Social Network
PMBOK	Project Management Body of Knowledge
QFD	Quality Function Deployment Method
RMAF	Results- Based Management Accountability Framework
ROI	Return on investment
SECI	Socialization, Externalization, Internalization, Combination
SIO	Social Investment Organization
SNA	Social Network Analysis
SPE	Society of Petroleum Engineers
UN	United Nations
UNEP	United Nations Environmental Programme
VHA	Veteran's Health Administration
VLC	Virtual Learning Center
WBCSD	World Business Council for Sustainable Development
WBT	Web Based Learning Systems

CHAPTER 1: INTRODUCTION

1.1 Background to the research

The growing concerns regarding issues of environmental sustainability—the onset of global warming, the need to safeguard our planet's ecological support systems, the need to reduce energy/resource use, and the overall maintenance of functional societies—comprise many of the challenges faced by the business world right now, and in the future (Siebenhüner and Arnold, 2007). These challenges will have a material impact on the way companies think and act presently, with one eye on the future (BCG, 2009).

Sustainability is becoming increasingly significant to businesses' strategy and management (BCG, 2009). One clear example of this reality can be found in the professional services firm *PricewaterhouseCoopers*' 6th annual Global CEO Survey (2003), the findings of which note that 79% of the CEOs surveyed agree that sustainability is vital to the profitability of any company, and that 71% of CEOs would sacrifice short-term profitability in exchange for long-term shareholder value when implementing a sustainability program (PricewaterhouseCoopers in conjunction with the World Economic Forum, 2003). However, a report released by the *Boston Consulting Group* on the "Business Case of Suitability" notes that a small number of companies are acting aggressively to reap sustainable rewards (BCG, 2009). Companies that act aggressively to pursue their sustainability initiatives in earnest tend to unearth opportunities to create new revenue streams, reduce costs, and develop more innovative business models (BCG, 2009).

The mining industry has a history of sustainability initiatives (see Appendix 1), though it also bears a record of unsustainable practices, including the abandoning of contaminated sites, and a disregard for ecological support systems within which they conduct their work. According to the Environmental Commissioner of Ontario's Annual Report (2012/2013), concerns regarding the safety and abandonment of mines have come to the forefront (Environmental Commissioner of Ontario, 2013). Most notably, severe environmental degradation caused by acid mine drainage from mine tailings and waste rock dumped at the Kam Kotia mine concentrated public and state

attention on the problems posed by abandoned mines (Environmental Commissioner of Ontario, 2013). Castrilli (2010) estimates that in Canada there are 10,000 orphaned/abandoned mine sites that require varying degrees of rehabilitation. Of those 10,000 abandoned mines, 5700 are located in Ontario as of the year 2007.

A report by the United Nations Environment Programme's Division of Technology, Industry and Economics describes abandoned mining sites as one of the key outstanding environmental problems related to international mineral extraction:

> "It is a legacy of centuries old practices and of inadequate, insufficient or non-existent mine closure. The potential costs of rehabilitation, the lack of clearly assigned (or assumed) responsibility, the absence of criteria and standards of rehabilitation and other factors have delayed action by all parties - industry, governments, and Communities". (UNEP2001, pg. 14)

Mining firms are starting to realize this and have begun to rebuild their corporate reputation, which is presently fraught with environmental devastation and social indifference. Mining companies are starting to find new sources of competitive advantage, innovation and value by integrating environmental considerations into their business strategies, products and processes (Rowledge, 1999). Transforming the mining industry and the general industrial system in pursuit of sustainable development requires and generates tremendous increases in individual and organizational knowledge. Knowledge management (KM)[1] can be applied to better manage and add value to that stock of sustainability knowledge[2] (Rowledge, 1999).

---

[1] Knowledge management (KM) is a "planned, structured approach of systematically and actively managing ideas, information, and knowledge of employees", and it could be an imperative component for accelerating an organization towards sustainability (Wu and Haasis, 2011).

[2] When we refer to "sustainability knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. environment (biodiversity and land stewardship, climate change, water management, etc.), economic (profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.) and social (worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.).

The basis of how KM can help an organization better manage and add value to the stock of sustainability knowledge is based on the notion that increased knowledge can lead to continuous improvement in performance and effectiveness. Theoretically, the more one knows as an individual (or as a team or business), the better one performs. Take for example a scenario where a mining firm is trying to manage its knowledge within a sustainability project. Knowledge management practices ensure that information from the past is transferred to the present, which will minimize time-wasting and recurring errors, all to help teams execute plans in the most effective and efficient manner. KM also helps harness the learning from one sustainability project to the next, accelerating the learning curve and improving sustainability performance.

1.2 Motivation for the research

The motivation for this research centers on two key observations. The first is the significance of knowledge management as a corporate survival skill (Garvin, 1993; Carnes et al 2002; Papavramides, 2006). For example, the rates at which organizations manage knowledge in our current modern knowledge economy may well become their only sustainable competitive advantage.

The second observation is based on the notion that little attention has been given to managing sustainability knowledge within the mining industry. Managing sustainability knowledge aids through improved decision-making, giving companies a competitive advantage. By creating systems of learning processes and by integrating them into the daily fabric of their operation, mining firms can have a better capacity to manage their learning more efficiently and leverage their knowledge gained from projects, resultantly becoming more effective at what they do (Papoutsakis, 2007; Garvin, 1998).

1.3 Purpose of the research

This thesis aims to identify and discuss KM[3] techniques that are used to manage sustainability knowledge in the Canadian Mining Industry. In particularly, this thesis will seek to do the following:

---

[3] Knowledge management is defined as "the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of

1. Identify and discuss existing practices of sustainability knowledge acquisition, sharing, and application in the mining industry.

2. Identify and discuss the existing practices of organizational culture, KM strategy, KM metrics, KM technologies, and the role played by senior management in promoting KM practices within their mining sustainability departments.

3. Present recommendations to better manage sustainability knowledge in the mining organizations explored.

1.4 Organization of the research

This thesis is organized in the following manner:

- Chapter 2: Contains a review of the current literature related to knowledge management, sustainability, sustainable mine management, the development of KM in another extractive sector industry (oil and gas) and the integration of KM and sustainability. An operational definition of KM as defined by Dalkir (2011) is presented and used throughout this research.

- Chapter 3: This chapter describes the specific methodology and approach used in the research. The chosen research approach is explained together with the procedure of data gathering and data analysis. In addition, this chapter explores ways to mitigate any bias that may occur in the research. Lastly, this chapter concludes with a brief discussion on the ethical issues that may arise in a variety of stages in business and management research.

- Chapter 4: Presents and discusses the results of the research.

- Chapter 5: Presents recommendations to better manage sustainability knowledge in the mining organizations explored.

- Chapter 6: Presents the conclusions for the research, limitations to the research and any opportunities for future research derived from the findings of the research.

---

valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning." (Dalkir, 2011)
* In this thesis, we follow the definition of "knowledge management" as defined by Dalkir (2011). This will allow us to qualitatively assess how sustainability knowledge is managed in the mining firms explored.

1.5 Findings of the research

This research identified and discussed existing practices of sustainability knowledge acquisition, sharing, and application in the mining industry and observed the following:

- Learning by observation/vicarious learning was the most common method of tacit knowledge capture at all levels; Individual and group level (8 firms expressed this) and organizational level (13 firms expressed this).

- More than half of the firms (8 firms) fail to codify tacit sustainability knowledge into an explicit form that is amenable for easy transfer and use by other staff members, thus showing weakness.

- One firm interviewed in this study experienced difficulties in project knowledge retention in sustainability projects. In particular, the firms expressed that they never have project close out meetings, and nor do they usually document "lessons learned " as a means of passing along the things that worked or didn't work on a project.

- A few 2 firms relayed that they "never "prevent the loss of sustainability knowledge due to human resource attrition.

- From the firms surveyed, 9 firms indicated that CoP's exist throughout the sustainability department and are maintained, monitored, and used to add value to the department by sharing lessons learned.

- There was not enough focus in visually mapping the relationship between people to identify knowledge flows. Of the firms' interviewed, 6 firms expressed that the visual mapping of employee relations to identify knowledge flow is not done

- Only 5 firms indicated that best practices are stored, constantly maintained and updated. However, 9 of the firms indicated that best practices is made available to a small portion of staff and but are not routinely updated.

- When it came to learning, during, before and after a sustainability project, the findings show that learning within sustainability projects occurs to a lesser extent in the beginning (7 firms expressed this), but rises a bit during (8 firms expressed this), and after a project (9 firms expressed this).

- One of the key obstacles to knowledge sharing in this study was a lack of time to share knowledge (5 firms expressed this concern). Other obstacles to knowledge sharing include: don't know who to share with (2 firms expressed this concern), don't know what to share (2 firms expressed this concern), different languages (3 firms expressed this concern), conception that knowledge is property (1 firms expressed this concern) and lack of effective communication (1 firms expressed this concern)

- In terms of knowledge application, a majority 13 of the firms indicated that they encourage employees to reuse knowledge to prevent reinventing the wheel.

The existing practices of organizational culture, KM strategy, KM metrics, KM technologies, and the role played by senior management in promoting KM practices within their sustainability departments were analyzed. In line with this, the major observations are as follows:

- A majority of the organizations surveyed (10 firms) expressed that knowledge sharing is the norm in their organizational culture.

- While knowledge sharing is the norm in the organizational culture of the firms we interviewed, it is often done poorly. The mining firms interviewed expressed certain barriers to a cultural change needed for KM to succeed. In particularly, 10 firms expressed that the lack of time and meeting places constitute a major barrier to a cultural change needed for KM to succeed. Other barriers to a cultural change needed for KM to succeed as expressed by the sustainability executives include; lack of common languages (4 firms expressed this), intolerance for mistakes (4 firms expressed this), lack of absorptive capacity (4 firms expressed this) and rewarding of knowledge hoarding (4 firms expressed this).

- A majority 10 mining firms surveyed expressed that that encouragement of innovation and continuous improvement is important to knowledge sharing. Additionally, they expressed that reward structure (4 firms expressed this), openness/transparency (5 firms expressed this), communication and coordination between groups (9 firms expressed this), trust (7 firms expressed this), and top management allocation (4 firms expressed this) are "important" to knowledge sharing.

- Of the firms surveyed, 8 firms expressed that there are no KM roles in the sustainability department. On the contrary, 4 firms expressed that some KM roles are laid out within the sustainability department for example CoP leaders, CoP facilitators and knowledge brokers.

- When it came to the use of tools and technologies to support the management of sustainability knowledge, 5 firms expressed that there is a general infrastructure of KM supportive technologies.

- Only 2 firms expressed that knowledge management is fully fixed into the business strategy of the firm.

- Of the firms surveyed, 10 firms expressed that monitoring of knowledge is not done. The firms that did measure their knowledge used various combinations of monitoring techniques such as the balance scorecard method, benchmarking, the house of quality matrix, and result based assessment framework.

CHAPTER 2: LITERATURE REVIEW

2.1 Knowledge -based economy

According to many scholars, governments and international organizations, we now live in a world where knowledge is one of the key factors propelling economic growth and productivity. A knowledge-based economy is one where people and organizations are able to acquire, create, disseminate, and utilise knowledge more effectively for economic and social development (World Bank, 2011). The rise of the so- called "knowledge economy" came about in the second half of the 1950s when it became increasingly clear to policy makers and economic analysts that the growth of western economies could not be explained by neoclassical economic factors such as land, capital, and labour (Cooke and Leydesdorff, 2006; Goldin 2006). As a result, the new growth theory as developed by economists like Romer, Lipsey, Grossman, and Helpman states in complimentary fashion that knowledge can also raise returns in investments and is a factor of production (Goldin, 2006; Romer and Paul, 1986; 1990). The economic doctrine of the new growth theory is becoming increasingly prevalent in the OECD (Organization for Economic Co-operation and Development) countries, as their economies now recognize their increasing reliance on the production, distribution, and use of knowledge (OECD, 1996).

From a report released by the OECD on "The Knowledge Based Economy," it is estimated that more than 50 percent of the Gross Domestic Product (GDP) in the major OECD economies is knowledge-based (OECD, 1996). Additionally, knowledge is increasingly thought of as being a valuable commodity that is embedded in products (especially high technology products), as well as in the knowledge of highly moveable employees (Dalkir, 2011). As knowledge continues to be perceived as a commodity and intellectual asset, there are some characteristics of knowledge that are different from other valued commodities (Dalkir, 2011). These characteristics include the following (Dalkir, 2011):

a) Knowledge is infinite - consumption will not diminish the supply of knowledge (i.e. knowledge is not subject to the laws of scarcity).
b) The transfer of knowledge does not result in the loss of knowledge.
c) Knowledge is plentiful, but the ability to use it is scarce.

d) Much of an organization's valuable knowledge could be lost due to staff turnover.

2.2 Managing knowledge in a knowledge based economy

The management of knowledge, as embodied in "human capital," is very important in today's economy. In a rapidly globalizing world economy, companies cannot expect to benefit from the same products and services that made them viable in the past (Davenport and Prusak, 1998). A company's greatest sustainable advantage will rest on the basis of how efficiently and effectively it manages its knowledge (Connor and Prahalad, 1996; Dalkir, 2011; Davenport and Prusak, 1998; Hall, 1993; Nonaka &Takeuchi, 1995b).

According to Fernandez and Leidner (2008), the most fundamental resource in today's economic climate is the shared knowledge residing in an organization's employees, customers, and vendors (Fernandez and Leidner 2008). Brown and Duguid (1998) refer to the premise that though all organizations are essentially knowledge organizations, the actual ability to excel in the market place depends on an organization's continuous generation and synthesis of collective organizational knowledge.

With the increasing importance of the strategic value of knowledge as a sustained competitive advantage, there is a need for a deliberate and systematic approach to cultivating and disseminating a company's knowledge base – one which embodies the best sustainable practices (Dalkir, 2011). Dalkir (2011) expresses this concern by stating that knowledge management would be a suitable tool to ensure the full utilization of an organization's knowledge base. Knowledge management has been observed as an imperative field of study, promoting the capture, creation, sharing, and application of organizations' knowledge to perform with the best practices, and not 're-inventing the wheel' by needlessly reworking from one project to the other (Dalkir, 2011; Nonaka and Takeuchi, 1995a; Pasternack and A. Viscio, 1998; Pfeffer and Sutton, 1999; Ruggles and Holtshouse, 1999). Dalkir (2011) proposes that a good definition of KM should be able to incorporate the capturing, creation, sharing and application of an organizations' knowledge together with the valuing of intellectual assets.

According to Stewart (1997), intellectual capital can be defined as organized knowledge that can be used to produce wealth. Intellectual capital (human capital) is inherent within a person's mind, containing the know-how, know-why and skills that are valuable to the business (Klein, 1998; Stewart, 1997; Van der Westhuizen and Kok, 2006). Intellectual capital is characterized less by content because content is sieved and judged, and only the best ideas are re-inventoried (the "top ten" for example)(Dalkir, 2011). Intellectual capital is more representative of the actual real thinking of individuals (i.e. opinions, stories, etc.), as it focuses on actionable knowledge and know-how (Dalkir, 2011). This leads to more of a focus on learning at the individual level, as opposed to the level of systems construction (Dalkir, 2011).

The comprehensive definition proposed by Dalkir (2011) that incorporates the capture, creation, sharing and application of an organization's knowledge together with the valuing of intellectual assets is as follows:

> "Knowledge management is the deliberate and systematic co-ordination of an organization's people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practises into corporate memory in order to foster continual organizational learning." (Dalkir, 2011, pg. 4)[4]

2.3 Forces driving knowledge management

Fernandez and Sabherwal (2010) highlight four underlying forces that drive the need for knowledge management in today's knowledge-based economy. They are as follows:

1. Increasing domain complexity: the complexity of internal and external processes, increased competition, and the fast advancement of technology are all directly proportionate to an increase in domain complexity. As direct consequences, the complexity of knowledge required by a company to complete a specific business task has increased. For example, the development of a new product in a company would no longer require the brainstorming sessions from the company's product designers, but

---

[4] In this thesis, we follow the definition of "knowledge management" as defined by Dalkir (2011). This will allow us to qualitatively assess how sustainability knowledge is managed in the mining firms explored.

would instead require the partnership of inter-organizational teams from a range of departments—from marketing to finance to engineering. Hence, team collaboration skills become very crucial in allowing employees to share their knowledge for the benefit of the organization.

2. Accelerating market volatility: the volatility within each market domain has increased in the past decade e.g. market and environmental influences can change an organization overnight.

3. Intensified speed of responsiveness: the time that it takes decision makers to take action based on subtle changes within and across domains is decreasing. The rapid advancement in technology continually changes the decision making landscape, making it imperative for decisions to be made faster, lest the window of opportunity closes.

4. High turnover rates: organizations experience high turnover rates as a result of voluntary decisions by the employee (e.g. due to opportunities for career advancement) as well as involuntary ones – for reason beyond the employees' control, like the termination of employment. Most organizations downsize in order to reduce cost and to survive competition. A negative side effect of such action is the dissipation of intellectual knowledge, or knowledge resources, which in turn leads to an overall net-loss for companies. Many of the employees who get laid off have accrued valuable skills over the years. Many organizations are not prepared for this leakage of intellectual assets. Few have taken the steps to prevent, or at least to neutralize this kind of loss. In order to minimize the impact of knowledge loss (due to downsizing), organizations should first identify what skills and information resources will be needed to meet mission-critical objectives. Therefore, effective methodologies, including tools and techniques to capture vital knowledge, are essential for an organization to maintain its competitive edge.

Faced with increased domain complexity, accelerating market volatility, and intensified speed of responsiveness, today's managers feel less adequate to be able to make difficult decisions on a relentless, day-to-day basis (Fernandez and Sabherwal, 2010). Viewed in a more general way, in the business world, Fortune 500 companies lose 31.5 billion US dollars a year by failing to share knowledge (according to International Data Corporation [IDC], a Framingham, Massachusetts.-based market intelligence/advisory firm that specializes in IT and telecommunications industries)

(Babcock, 2004). Such a dramatic number should fuel the need for companies to proactively implement KM systems in order to help them increase their chances of success by facilitating decision making, building sufficient learning environments, and fostering cultural change and innovation (Quast, 2012).

2.4 The nature of knowledge

According to the literature on knowledge management, it is often mentioned that the ability to differentiate between data, information and knowledge is paramount (Bhatt, 2011, Jing et al, 2009; Zins, 2007). There is a conceptual and intellectual consensus that treats data as facts, observations, or perceptions, which relay something specific, though not organized in any way to provide information regarding patterns (Fernandez and Sabherwal, 2010). For example, the sales order in a restaurant that includes 2 eggs and 2 coffees is an example of data. Such data is devoid of any real content, meaning, or intent. It is simply a raw representation of numbers. Information on the other hand is data that possesses context, purpose or actual relevance. This involves the manipulation of raw data in order to represent or relate to a meaningful pattern in the data. So for the restaurant manager, "information" would be the number representing daily sale by quantity or percentage of sales for, say, coffee or eggs. Knowledge is information that facilitates action. So the sale of coffee and eggs could be used with other information such as the quantity of eggs and coffee in the inventory to determine the amount of coffee and eggs needed to keep things going. The relationship between the quantity of eggs and coffee to buy, the coffee and eggs in the inventory, and the daily sales of coffee and eggs, is an example of knowledge (Fernandez and Sabherwal, 2010). Authors such as Ackoff posited a hierarchy at the top of which lay wisdom, and below that understanding, knowledge, information, and data, in that order. Furthermore, he wrote that "each of these includes the categories that fall below it," and estimated that "on average about forty percent of the human mind consists of data, thirty percent information, twenty percent knowledge, ten percent understanding, and virtually no wisdom" (Ackoff, 1989,p.g 3).
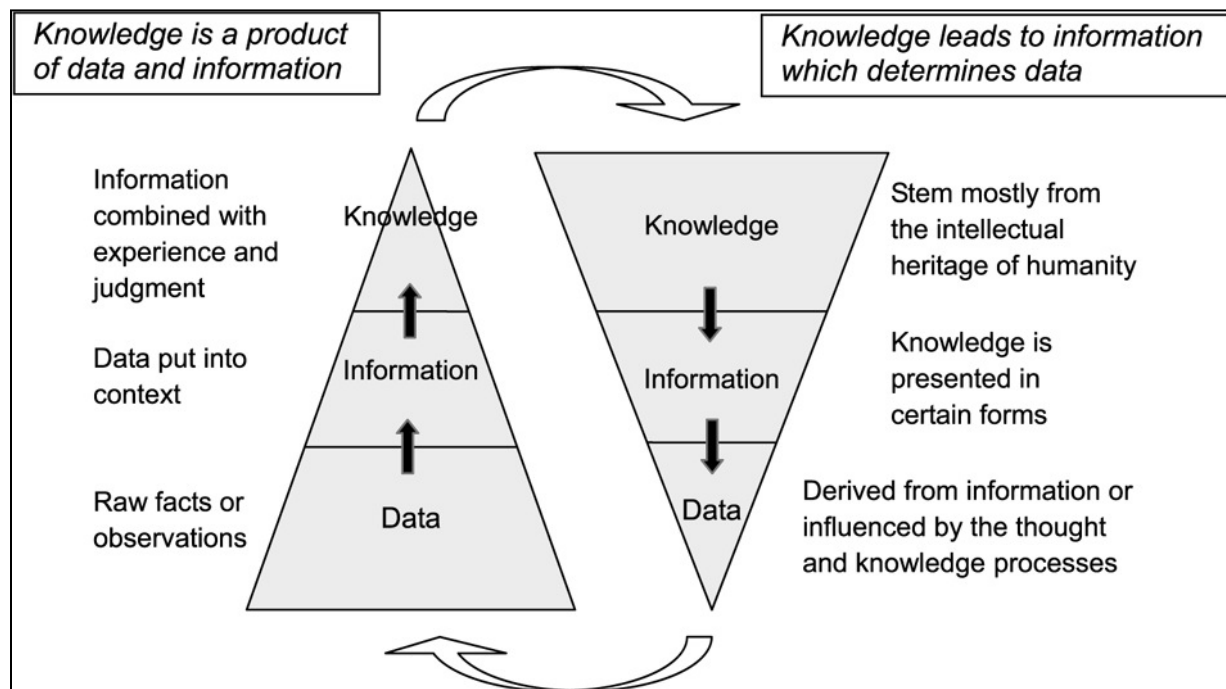
Figure 1: The hierarchical data-information-knowledge (Jing et al, 2009)

2.5 Polanyi's work on tacit knowledge

Polanyi (1958) a leading chemist who became disenchanted with the scientists' view of knowledge suggests that some types of knowledge have limited capability for transfer, e.g. according to Polanyi:

> "Art which cannot be specified in detail cannot be transferred by prescription, since no prescription for it exists. It can be passed on only by example from master to apprentice. This restricts the range of diffusion to that of personal contacts." (Polanyi, 1958. pg. 55).

Polanyi (1958) extends his discussion by emphasising the functional aspect of knowledge, i.e. he regards knowledge as a tool by which we either act or gather new knowledge. This tool is unreflected knowledge that we take for granted in a situation (he gives the example of hammer and nail, which is quoted below).

13

"When we use a hammer to drive a nail, we attend to both nail and hammer, but in a different way....The difference may be stated by saying that the latter (hammer) are not, like the nail, objects of our attention, but instruments of it. They are not watched in themselves; we watch something else while keeping intensely aware of them. I have a subsidiary awareness of the feeling in my palm of my hand which is merged into my focal awareness of my driving the nail."(Polanyi, 1958. pg 55).

Polanyi believes that all knowledge has a tacit component (Polanyi, 1958). He discusses the process by which "the tacit cooperates with the explicit, the personal with the formal" (Polanyi, 1958, pg.87). Additionally, tacitness is something personal, an ability or skill to do something or to resolve a problem that is based, in part, on one's own experiences and learning (Grant 2007). With the appropriate use of language, much, perhaps most, but probably not all, of this knowledge can be shared between individuals who share a mutually agreed language (Grant, 2007). When the tacitness predominates so that articulation cannot be expressed in language Polanyi calls this "ineffable" knowledge (Grant 2007).

To demonstrate the principle of ineffable tacit knowledge , Polanyi uses topographic anatomy as an example. He writes:

" The majority difficulty in the understanding, and hence in the teaching of anatomy, arises in respect to the intricate three- dimensional network of organs closely packed inside the body… It is left to the imagination to reconstruct from such experience the three dimensional picture of the exposed area as it existed in the unopened body , and to explore mentally its connections with adjoining unexposed areas around it and below it" . Then continues " The kind of topographic knowledge which an experienced surgeon possesses of the regions of which he operates is therefore ineffable knowledge (Polanyi, 1962, pg 92).

2.6 The two types of knowledge: tacit and explicit

Knowledge has been classified and characterized in several ways. The two major types of knowledge are "tacit knowledge" and "explicit knowledge." It's acknowledged that tacit knowledge is difficult to articulate and to put into words, texts, or drawings. It resides within the minds of those who possess it (Dalkir, 2011). Explicit knowledge represents content that has

been captured in some tangible form, such as words, audio, recordings, or even images. It is usually contained within tangible media (Dalkir, 2011). The properties of each are expressed in Table 1.

Tacit knowledge can be converted into explicit knowledge. There are 4 modes (Figure 2) of doing so (Nonaka and Takeuchi, 1995):

- From tacit knowledge to tacit knowledge: process of socialization
- From tacit knowledge to explicit knowledge: process of externalization
- From explicit knowledge to explicit knowledge: process of combination
- From explicit knowledge to tacit knowledge: process of internalization

Properties of Tacit Knowledge	Properties of Explicit Knowledge
Ability to adapt, to deal with new and exceptional situations	Ability to disseminate, to reproduce, to access and re-apply through the organization
Expertise, know- how, know -why, and care why	Ability to teach, to train
Ability to collaborate, to share a vision, to transmit a culture	Ability to organize, to systematize, to translate a vision into a mission statement, into operational guidelines
Coaching and mentoring to transfer experiential knowledge on a one- to- one, face to face basis	Transfer knowledge via products, services and documented processes

Table1: Comparison of properties of tacit vs. explicit knowledge (Dalkir, 2011)
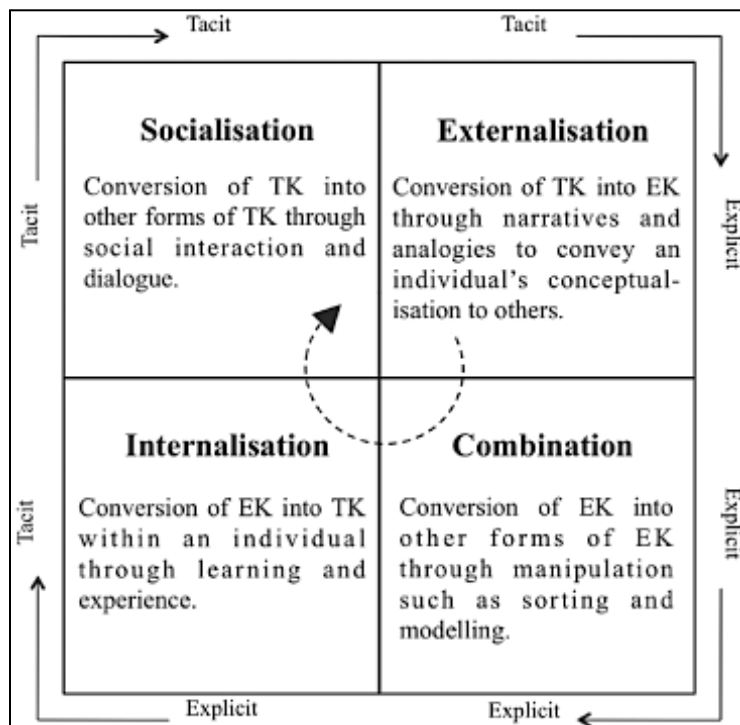
Figure 2: The SECI model (Mohamed and Amr, 2013). Adopted from *(Nonaka and Takeuchi, 1995).*

The processes described in Nonaka's model can support KM activities in more than one way as depicted in figure 3.
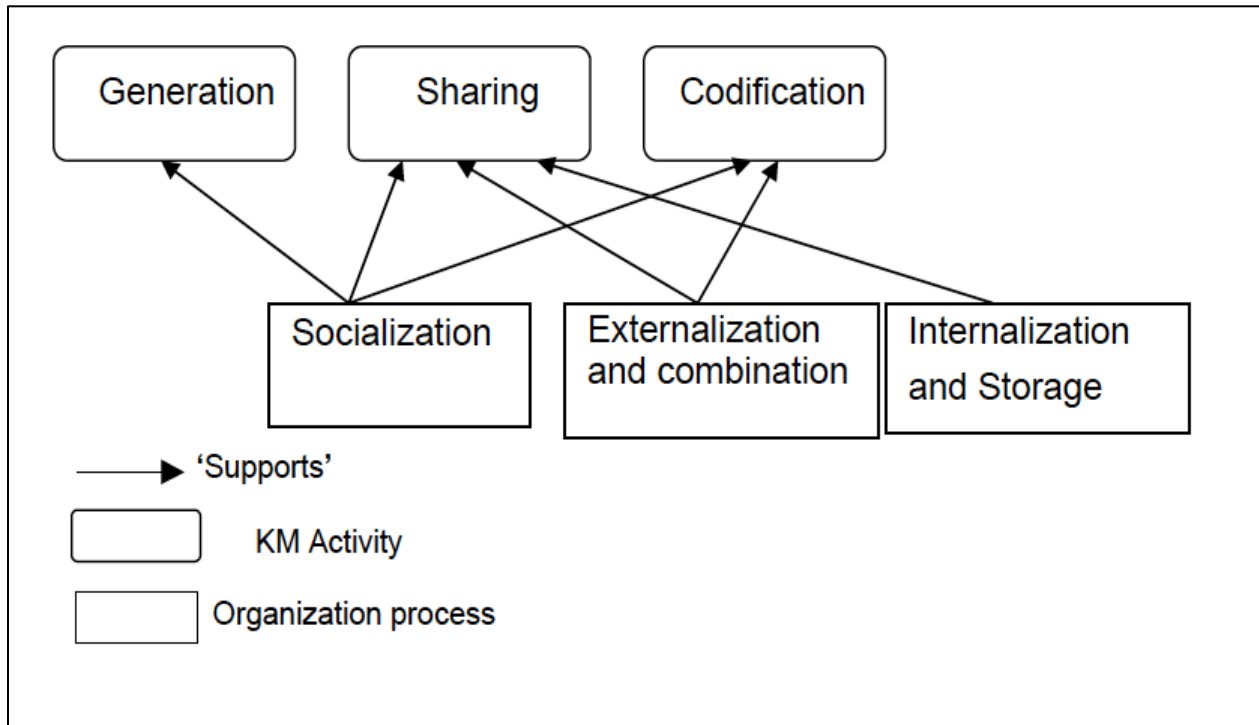
Figure 3: KM activities and supportive processes (Dorit, 2003).

2.7 Organizational impacts of knowledge management

Fernandez and Sabherwal (2010) highlight the organizational impacts of KM. They are as follows:

2.7.1 Impacts on people

KM's largest impact on an organization's employees is its facilitation of employee learning (through externalization, socialization, internalization, combination). KM can impact employee adaptability as employees are likely to adapt when they interact with each other and respond to change more efficiently. KM also causes employees to share knowledge, resulting in them

becoming more flexible, thus enhancing their job satisfaction. Fig 4 shows a schematic diagram of how KM impacts people.
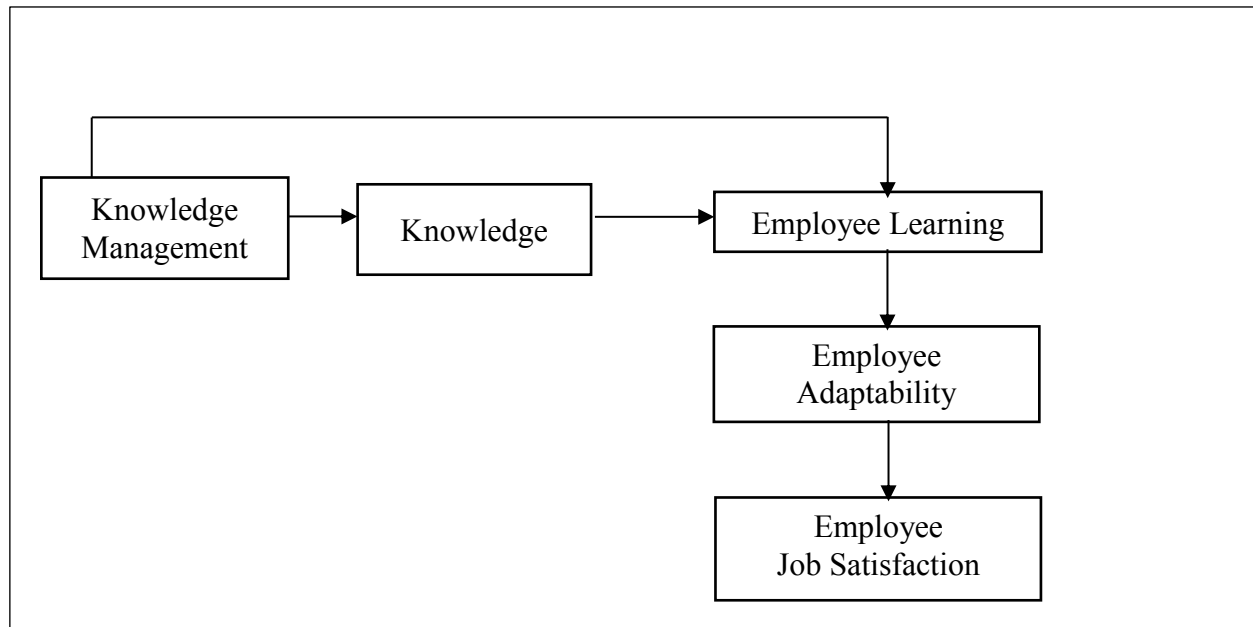
Figure 4: KM impacts on people (Fernandez and Sabherwal, 2010).

2.7.2 Impact on processes

KM allows organizations to be more effective by giving them the ability to select and perform the most appropriate processes, thus leading to fewer mistakes made over time. KM also allows organizations to quickly adapt their processes to the current circumstances, thus maintaining effectiveness in changing times. By managing knowledge effectively, organizations are able to become more productive and efficient. Additionally, KM can also have an impact on process innovation as knowledge shared across individuals can ignite innovative solutions to problems, as well as develop innovative organizational processes. Figure 5 shows a schematic diagram of how KM impacts organizational processes.
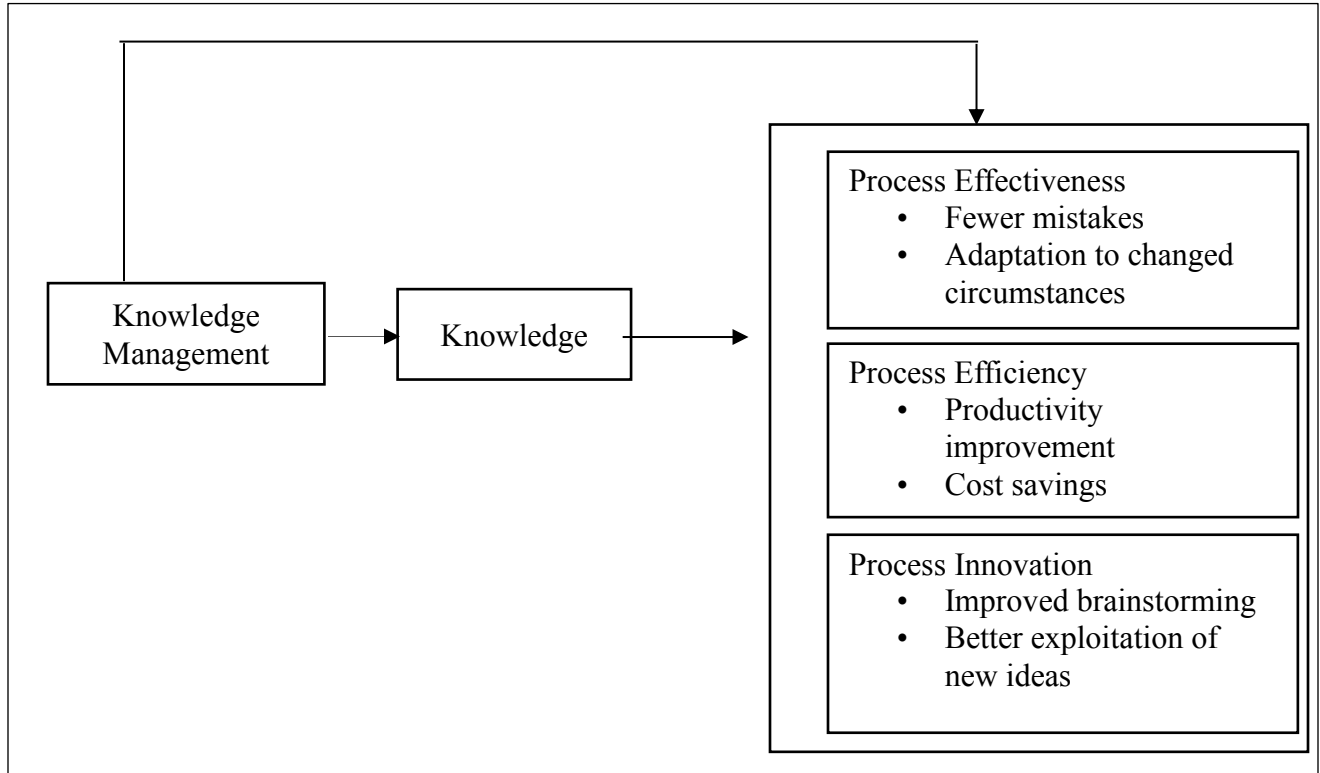
Figure 5: KM impacts on organizational processes (Fernandez and Sabherwal, 2010).

2.7.3 Impact on products

KM can have an impact on value added products, as well as knowledge based products. With respect to KM's impact on value added products, its primary ability has to do with the assistance of companies with their new/enhanced products, which are more valuable in comparison to earlier products. An example of this is Ford's Best Practices Replication Process in manufacturing. Ford's headquarters requires a "task" manager to come up with improvements (5%, 6% or 7% improvement) in key measures each year. The managers would seek best practices databases in order to obtain knowledge on prior successful efforts. Ford claims that its "best practice" system, which it tracks in meticulous detail, has saved the company $245 million

US dollars from 1996 to 1997. KM can also have an impact on products that are knowledge based, such as in consulting or software development industries.
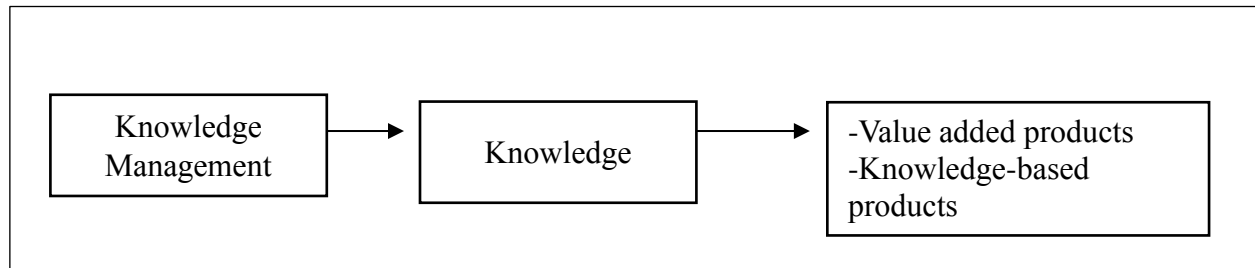
Figure 6: KM impacts on products (Fernandez and Sabherwal, 2010).

2.7.4 Impact on organizational performance

Knowledge management can have an impact on organizational performance in two ways, indirectly and directly. Direct impacts of knowledge management on organizational performance occur when knowledge is utilized to create innovative products in order to generate profit and revenue. This happens when the organization's knowledge management strategy is aligned with its business strategy. Such direct impact concerns revenue and/or costs and can be explicitly linked to the organization's vision or strategy. Indirect impacts of knowledge management on organizational performance happen through the use of KM to show intellectual leadership within the industry, which may improve customer loyalty as a result. Indirect impacts of knowledge management on organizational performance can also occur through the use of knowledge to gain an advantageous negotiating position in relation to other competitors.
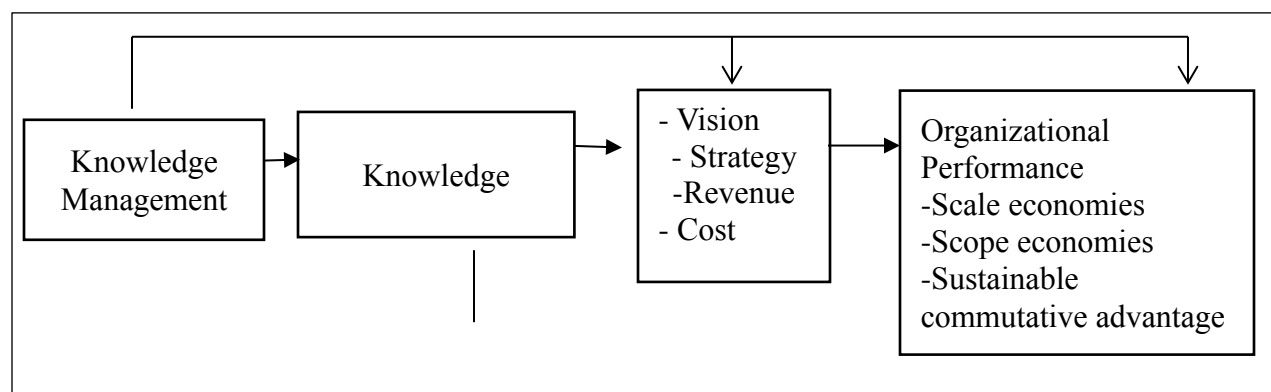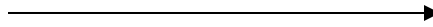
Figure 7: KM impacts on organizational performance (Fernandez and Sabherwal, 2010)

Empirical evidence on the benefits of KM was explored by North et al (2004). In their study, 48 German enterprises of different industries were evaluated based on a standard questionnaire. The 48 companies had introduced KM over a year before the study was conducted and demonstrated an improved performance over that period of time. Each group was asked to state the improvements in qualitative and quantitative terms. Benefits were assessed from the following perspectives: learning and growth (employees, internal business processes), customers, and financial results. From a "processes" perspective, benefits were realized in the area of process acceleration, the reduction of redundancies and the re-use of internal knowledge.

With respect to how knowledge management benefits employees, dominant responses were as follows: increase of motivation, enhancement of personal knowledge base, and the minimizing of on-boarding time for new employees.

2.8 The development of knowledge management in the oil and gas Industry

According to Grant (2013), the oil and gas industry has been at the forefront of the development and deployment of KM as a result of several factors, some of which include;

- Technological and market changes in the oil and gas industry started becoming more and more intense during the 1990s and first decade of the 21st century.
- The pressures resulting from the depletion of established fields, the need to explore in frontier locations such as deep waters, and pressures to be environmentally responsible has provided massive impetus for technological advance. Upstream technologies have rapidly moved fast in relation to seismology, drilling technologies, and offshore E&P.
- The rapid improvement of information communication technologies have made it possible for companies to be able to gather and process unprecedented quantities of data while providing the means for employees spread throughout the globe to communicate and collaborate closely.

According to Grant (2013), most mining firms have undergone a major change in their "dominant logic". 20 years ago, management in the most mining firms was viewed in

engineering terms: tangible inputs—finance, equipment, and people—were deployed to acquire physical assets such as oil and gas reserves—which were then transformed into marketable end products through a "vertically-integrated system". However, since the early 1990's, large international, shareholder-owned oil and gas companies came to the realization that they are operating in a knowledge-based business where superior performance is achieved through the early identification and assessment of opportunities and their speedy exploitation (Grant, 2013). Whilst medium sized oil companies had to rely on the ownership of low cost reserves for their preeminence on the oil and gas production, most large oil and gas firms had to change in order to maintain a competitive advantage by relying on learning capabilities, improved technology, management systems and innovation (Grant, 2013). By the early years of the 21st century, Schlumberger, BP, Royal Dutch Shell, and Chevron had become mining leaders in the field of knowledge management (Grant, 2013).

Table 2 shows the establishment for KM in the various major oil and gas companies.

Company	Adoption of KM	Origins of KM
BP	1996	Organizational learning/best practices transfer in upstream.
Royal Dutch Shell	1995	Organizational learning initiatives by corporate planning (e.g. scenario analysis, cognitive maps)
Chevron	1996	Best practices transfers & cost reduction in Chevron's downstream businesses
ExxonMobil	2003*	In Exxon: application of IT to E&P. In Mobil, best practice transfer in downstream
ConocoPhillips	1998	IT support for E&P
Schlumberger	1997	IT applications to drilling
Halliburton	1998	IT applications to drilling and seismic analysis

Marathon Oil	1999	IT applications to exploration
Murphy Oil	2000	IT applications to exploration
BHP-Billiton	2000	KM uninitiated by IT dept. - but not adopted company-wide
Paragon Engineering Services Inc.	1999 (approx.)	KM practices based upon groupware, intranet, project files, & other IT tools

Table 2: KM in various major oil and gas companies. Adopted from Grant, 2013.

*ExxonMobil has not formally committed itself to KM at the corporate level, however, by early 2003, the term KM was used widely both on upstream and downstream businesses.

Table 3 shows the motives for adoption of KM in certain oil and gas companies.

Company	Motives for Adoption of KM
BP Amoco	Following radical organizational decentralization, KM viewed as mechanism for achieving lateral coordination.
Royal Dutch/Shell	In Shell's highly decentralized multinational structure, KM was a natural complement to strategic planning and career management as an integrating mechanism. With poor profitability during early 1990s, Shell came under strong pressure to make more effective use of its dispersed talent.
ChevronTexaco	Chevron's adoption of KM driven by pressured for cost reduction during early 1990s. Resulted in strong interest in transfer of best practices.
ExxonMobil	Mobil enthusiastic adoption of KM during the mid-1990s was driven primarily by its desire to improve efficiency in E&P and in refining through improved identification and transfer of best practices.
ConocoPhillips	Expansion of exploration, especially in deep-water Gulf of Mexico, created need for data management systems to support huge amounts of data being generated and processed and link them to decision processes.

Schlumberger	Impetus for KM came from need to link rapidly advancing data
Halliburton	management with systems that linked human Halliburton
	expertise in globally distributed operations.
Marathon Oil	Desire to improve upstream performance through more effective
	linking of people to people and people to information.

Table 3: Motives for adoption of KM in certain specific oil and gas companies. Adopted from Grant, 2013.

The study conducted by Grant (2013) on the evolution of knowledge management practices among a sample of oil and gas companies is imperative to KM research as it points to the substantial potential for KM to boost efficiency, facilitate learning, build organizational capabilities and accelerate innovation in global, technology-intensive extractive sector firms. While Grant (2013) does not address KM specifically in relation to sustainability, it is logical that oil and gas companies at the time of his study were including sustainability practices within their general management practice and therefore it could be argued that their knowledge management practices would address sustainability; this research is comparable to his study in that it examines the KM experiences of global, technology- intensive Canadian-based mining firms facing constantly changing business and operating conditions.

2.9 Sustainable mine management
2.9.1 Introduction to sustainability and sustainable development

The meaning of "sustainable development" varies along the context in which it is applied and the scale it is being considered. Various authors have attempted to clarify what is meant by "sustainable development." Some authors are concerned with the "sustainability of the natural resource base" while others with "present or future levels of production and consumption". While the concept of sustainable development is very useful in facilitating a bridge for public discussion, its definition is ambiguous, as there is a difference in opinions between several authors over the ways in which sustainable development might be achieved. The following authors have made an attempt in clarifying what is meant by sustainable development.

Redclift (1992) argues that there are three parameters to sustainable development

1. Ecological parameter- a focus on the ecological parameter supposes that the natural resource base, particularly renewable resources should be protected and sustained.
2. Economic and political parameter– advocates for an economic and political emphasis argue that sustainable development should focus on social and economic objectives such as reducing absolute poverty by providing better livelihoods to people.
3. Sustaining cultural systems and peoples – if people acknowledge the significance of different cultural definitions of needs and the means of obtaining those needs then one attends to issues of sustaining cultural systems and peoples.

Similar to Redcliff, Goodland (1995) alludes to the premise that sustainable development should integrate social, environmental and economic sustainability. Goodland (1995) however mentions that environmental sustainability can be classified into three degrees- weak, strong and absurdly strong- all depending on the four types of capital (natural -soil, atmosphere, forests, water, and wetlands, human, human-made, and social): *Please note that the four types of sustainability capital are quite different from the more widely used model in the knowledge management intellectual capital area (relationship, structural and human)*

- Weak environmental sustainability implies that the four types of capital can be substituted for each other e.g. human-made artifacts can substitute natural capital with no negative effects on society.
- Strong environmental sustainability recognizes that the four types of capital are not perfect substitutes to each other, they are complimentary to each other to some degree in most production functions e.g. a human -made capital such as a sawmill is of no worth without natural forests (natural capital) . Goodland and most ecological economists support this view.
- Absurdly strong environmental sustainability expects humans to never deplete anything. No resources could ever be exploited – all minerals would remain in the ground.

Sunderlin (1995) on the other hand examined the concept of sustainable development in terms of three classical sociological paradigms - the class, managerial, and pluralistic traditions. The

opposition of sustainable development tends to be found in the class and pluralistic paradigms while support for sustainable development is found in the managerial paradigm.

Sunderlin (1995) describes how the class theorist tend to observe the world as mutually antagonistic social groupings as they tend to view economic development as a means for the affluent and powerful in the "north" to enhance their economic positioning in comparison to poor people in the "south" . Class theorists are more inclined to dislike government attempts to regulate the environment at the global level.   Managerial theorists on the other hand tend to support sustainable development. Sunderlin (1995) splits the managerial perspective into two sections, "progressive managerialists" and "mainstream managerialists". Progressive managerialists deem that political and cultural transformations should happen in industrialized countries in order to avert environmental catastrophes. Mainstream managerialists on the other hand support a solution for environmental sustainability that focuses on appropriate polices, sound management decisions and the development of new technologies. Lastly, proponents of the pluralistic perspective tend to oppose sustainable development as they tend to view it from a perspective where government interference in resource management. Proponents of the pluralistic perspective tend to be supportive of "free market environmentalism".

In summary, Sunderlin (1995) argues that he sees little prospect for a unified theory in sustainable development. While various ideologies fit into the "three paradigms" the ideologies are value laden, representing different interests within society at large. Sunderlin (1995) believes that an effort for constructive dialogue for a unified concept or theory for sustainable development is needed.

2.9.2 Sustainability on the rise (the business case for sustainability)

Sustainability has progressively become a business issue of the 21st century. Many leading companies in Canada are embracing this and its link to economic success and competitive advantage. According to a 2011 report by KPMG on corporate sustainability, it was found that;

- Sustainability has moved up the corporate agenda in the last three years (62% of companies surveyed have an agenda for corporate suitability, despite a tough economic

environment, 5% had no plans to create a strategy while the remainder where in the process of creating a plan).

- Sustainability key drivers are changing. While regulatory requirements, brand enhancement and risk management remain key drivers, cost reduction is also a key driver.

- Sustainability is viewed by organizations as a source of innovation and new growth (44% of business executives agree that sustainability is a source of innovation, while 39% see it as a source of new business opportunities. Far fewer organizations disagree.

- Organizations are increasingly measuring and reporting on their sustainability performance (36% of the companies that were polled had one public report on sustainability while 19% were planning to do so- 38% had no plans to do so.

- Of the companies surveyed, 67% of executives want a successor to the Kyoto protocol; while 8% believe that a new set of rules to replace the Kyoto protocol is not important.

2.9.3 The business case for suitability specifics

According to the World Business Council for Sustainable Development (WBCSD), it was identified that eco- efficiency, corporate social responsibility and innovation are the main business contributions to sustainable development (UK Government, Department for Business Innovation & Skills, 2006). Moreover, the WBCSD believes that businesses can benefit from pursuing sustainable development in two basic ways - by driving cost efficiencies and by generating top-line growth (Strandberg, 2009). Table 4 explores this in detail.

Driving down costs (i.e. return on capital including work efficiency and operational efficiency)	Generating top line growth through innovation and new markets

Cost savings from improved operational performance and efficiencies.
 	
  ▪ Through process optimization i.e. reduction in material inputs, efficiency in energy utilization and reduction in waste.
  ▪ Improved product quality and reduced error rates.
  ▪ Faster permitting and improved relations with regulators.
	Increased revenue from new markets and price premiums.
	
	  ▪ According to a 2005 GlobeScan CSR monitor survey, 92 % of Canadians surveyed said that they were likely to purchase their products or services from socially and environmentally responsible companies.

Cost avoidance by minimizing business risks and improving safety.
 	
  ▪ Corporate Responsibility (CR) provides businesses with means of understanding and managing their risks. By establishing a comprehensive CR strategy and agenda, businesses are able to curb down on legal, environmental and societal risks.
  ▪ Avoid litigation (i.e. legal claims and expenses related to accidents).
  ▪ Social license to operate- uninterrupted operations can be facilitated by using local sustainability efforts and engaging members of the community in dialogue.
  ▪ Addressing sustainability issues can reduce reputational risk and negative publicity through boycotts.
	▪ Improved recognition and reputation. Sustainability is an intangible asset that has the ability to improve a company's reputation and differentiate a brand. Reputation or brand quality is created on imperative values such as trust, credibility, reliability, consistency and quality. According to a 2002 CSR survey by Globescan, it was found that 89% of Canadians have more respect for a company when the CEO speaks of CSR.

Cost savings form improved recruitment and retention of employees.
 	
    ▪ A survey that was conducted by the Conference Board of Canada showed that 71% of employees would want to work for companies that are committed to social and community concerns. (Government of Canada, 2011).
 	
    ▪ Able to attract the best and brightest amongst graduates. The Aspen Institute's 2007 study of MBA students found them to be more interested in work that had some contribution to society (26% of respondents relayed that it was a significant factor in job selection as opposed to 15% Government of Canada, 2011). A 2003 Stanford University study by Montgomery and Ramus (2003) on "Corporate Social Responsibility Reputation Effects on MBA Job Choice" found that MBA graduates would sacrifice an average of $13,700 in their salary in order to work for a socially responsible organization.
	Improved access to capital.
	
	    ▪ Sustainability could lead to improved reputation with investors, bond agencies and banks. There is a small growing trend in the investment community to use environmental and social performance factors in order to determine a companies, liabilities, risks and suitability for investments; According to the Social Investment Organization (SIO), $609 billion of Canadian assets as of 2008 were invested in socially responsible investing in comparison to $503 billion dollars in 2006 (20% increase in 2 years).

Table 4: The specifics of how businesses can benefit from sustainable development through driving cost efficiencies and by generating top-line growth (Strandberg, 2009; GlobeScan 2006; Montgomery and Ramus, 2003)

2.9.4 What sustainability means for mine management?

The meaning of sustainability in the mineral industry should relate to the responsible and effective management of mineral assets, environmental, community and economic issues (Bostin, 2009). Achieving this will require that sustainability is integrated in all organizational levels (corporate, divisional and operational), all functional levels (strategy, planning and

implementation) and all stages of the mine life cycle (exploration, project production and post-production) (Bostin, 2009).

In practice, most mining companies undertake a variety of activities that are aimed at sustainability or sustainable development. Yakovleva (2005) groups these activities into three groups i.e. the natural environment, worker health and safety and community development and stakeholder engagement. From 1998 to 2001, the annual reports and other published material from the world's ten largest gold mining companies indicated that the 10 companies made commitments and disclosures regarding the natural environment, worker health and safety and community development and stakeholder engagement (Bostin, 2009). With regards to the environment, the 10 firms committed to meet environmental rules and regulations, improve environmental performance, meet the standards of sustainable development, reduce any environmental impacts that may result from operating; they had environmental management plans and systems in place for environmental monitoring, water management, tailing management, air quality, revegetation and rehabilitation, assessment of ecological risks and environmental impacts, reporting of environmental performance and independent environmental audits.

With regards to the area of worker health and safety a majority of the gold mining firms had health and safety policies in place, health workshops and programs, HIV/AIDS monitoring of all workers and health and safety audits. Lastly, in relation to community development and stakeholder engagement, the gold mining firms had in place social and community policies, consulted with stakeholders throughout the lifecycle of the mine, offered training and education to members of the community, contributed to community activities including schools, health clinics, and cooperated with NGO's, governmental and social programs and established philanthropic foundations (Bostin, 2009).

Applying any of the principles of sustainability as mentioned above whether it is in a mine or community is not straightforward or simple and would require the development of appropriate processes to balance environmental, economic and social considerations (Bostin, 2009). One way of putting sustainability and sustainable development into practice in the mining sector is

through the use of the "Seven Question Framework" (Bostin, 2009). The Seven Question framework developed by Mining, Minerals and Sustainable Development (MMSD) helps guide the assessment of whether a project's net contribution to sustainability over the long term of a mining/mineral project or operation will be positive or negative (International Institute for Sustainable Development, 2002). Figure 8 shows the Seven Question framework developed by Mining, Minerals and Sustainable Development (MMSD).
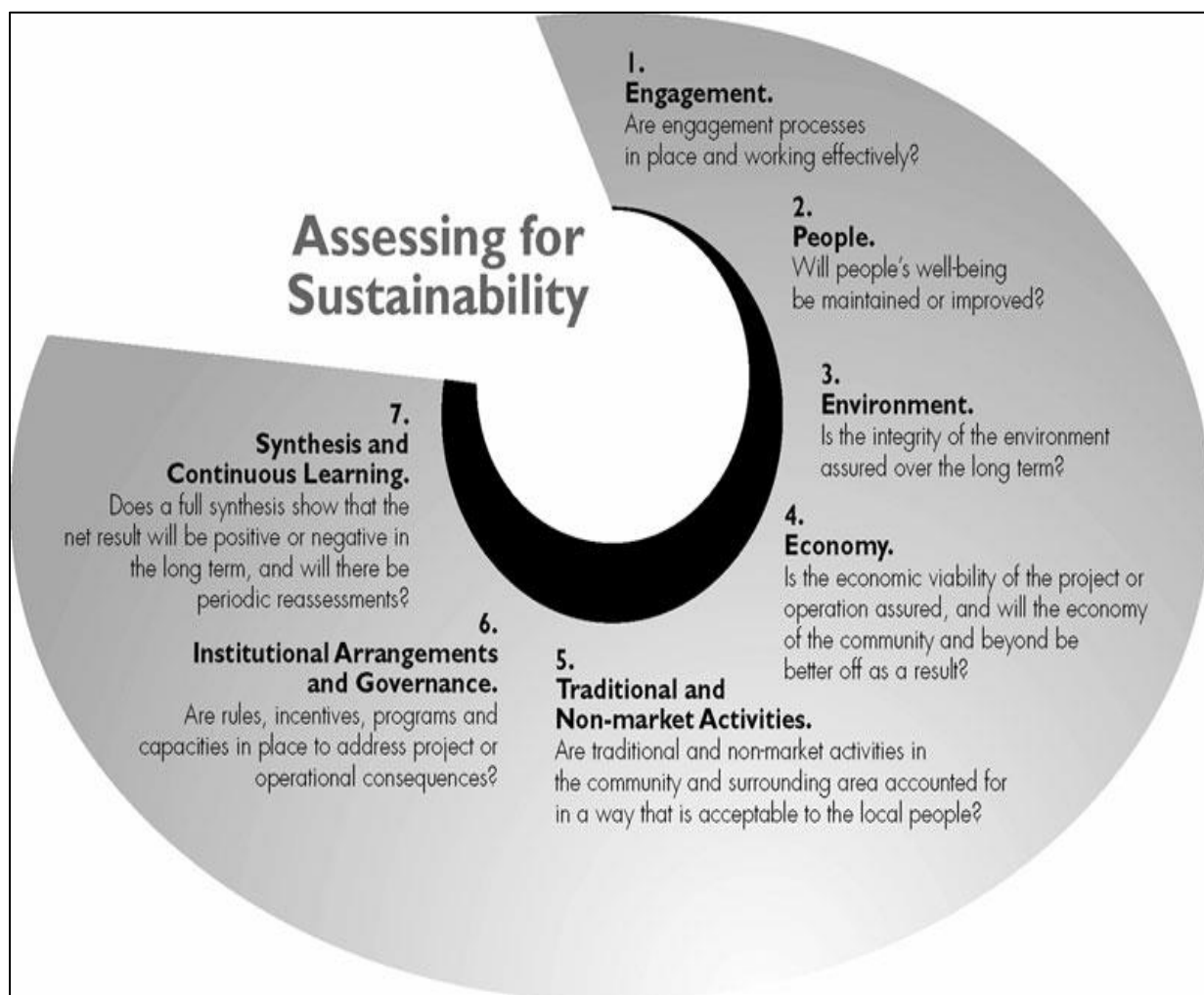
Figure 8: The Seven Question framework developed by Mining, Minerals and Sustainable Development (MMSD) (International Institute for Sustainable Development (2002).

Each of the questions in the framework is answered through the assessment of a hierarchy of more specific questions, indicators and measures (Bostin, 2009). Moreover, the World Bank and the International Council on Mining and Metals (ICMM) developed a more detailed framework in order to guide the interaction between mining firm and the general community (ESMAP, World Bank, and ICMM, 2005). The toolkit comprises 17 tools to enable community development throughout the entire mine life cycle (See Appendix 2 for an Overview of the ICMM's Community Development Toolkit as developed by the World Bank and the International Council on Mining and Metals (ICMM)).

2.10. Literature on knowledge management and sustainability

Knowledge management practices and corporate applications of such practices are rapidly growing. A 1999 Pricewaterhouse Coopers Global survey of CEOs shows that 97% of more than 800 CEOs consider knowledge management "critical" (Rowledge, 1999). Driven by innovation, speed to market, and quality improvements, businesses are starting to harness the intellectual assets of its workers. This effort to harness the "Knowledge-creating capability" of a business is one of the key elements of the information revolution that is changing the competitive landscape of businesses (Rowledge, 1999).

Another revolution that is redefining the competitive landscape of business is the notion of sustainability. Companies are starting to find new sources of competitive advantage, innovation, and business value, all by integrating sustainability considerations into business processes, strategies, and products (Rowledge, 1999). Transforming our industrial system in pursuit of sustainable development both requires and generates a tremendous increase in individual and organization knowledge. Knowledge Management (KM) can be applied to add value to that stock of sustainability knowledge. The new global economy will progressively require sustainable industrial practices, and such practices will be enabled by knowledge management.

Several authors have examined the mutually beneficial integration of knowledge management and sustainability from the standpoint that knowledge management should be informed by, and contribute towards, the development and realization of environmentally and socially sustainable

business strategies and practices (Rowledge, 1999; McNeil, 2011).

Authors, namely, Allen et al. (1998), Wu and Haasis (2011) and Gloet (2006) employ KM frameworks or KM conceptual models to evaluate the application of knowledge management to achieve sustainable capacity in varying industries or cases. Further descriptions of their studies are presented below.

Allen et al. (1998) in their study describe how in rural New Zealand, an integrated and community-based research approach has the potential to support natural resource management decision-making, leading ultimately to sustainability. It was found that the Integrated System of Knowledge Management (ISKM) framework has the potential to support ongoing processes of constructive community dialogue so that people can share their experiences and observations, ultimately leading towards sound decision-making for sustainability problems and practical resource management decision support for land managers and policy makers. The ISKM framework shown in figure 9 "builds on the principles of experiential learning and systems thinking, and is applicable to developing the knowledge and action needed to change real situations constructively." The first step (scoping goals and objectives) stresses the understanding of an issue or problem. This involves a scoping process to help the individuals involved define the nature of the issue or problem. This serves as a basis for determining the needs of the various interest groups that are involved, and the specific goals and outcomes they wish to achieve .The second step of the ISKM process aims to bring together local and scientific knowledge systems. For instance, land managers are very knowledgeable on their local systems as a result of years of experience. This information is rarely explicitly documented in a tangible form and aren't available to land managers on a collective basis. Likewise, much of the knowledge that scientists have is fragmented in different databases, and not always made readily available either. This second step also helps provide a basis for the design of interview groups, focus groups, etc. in order to unlock relevant knowledge from the local and research community.
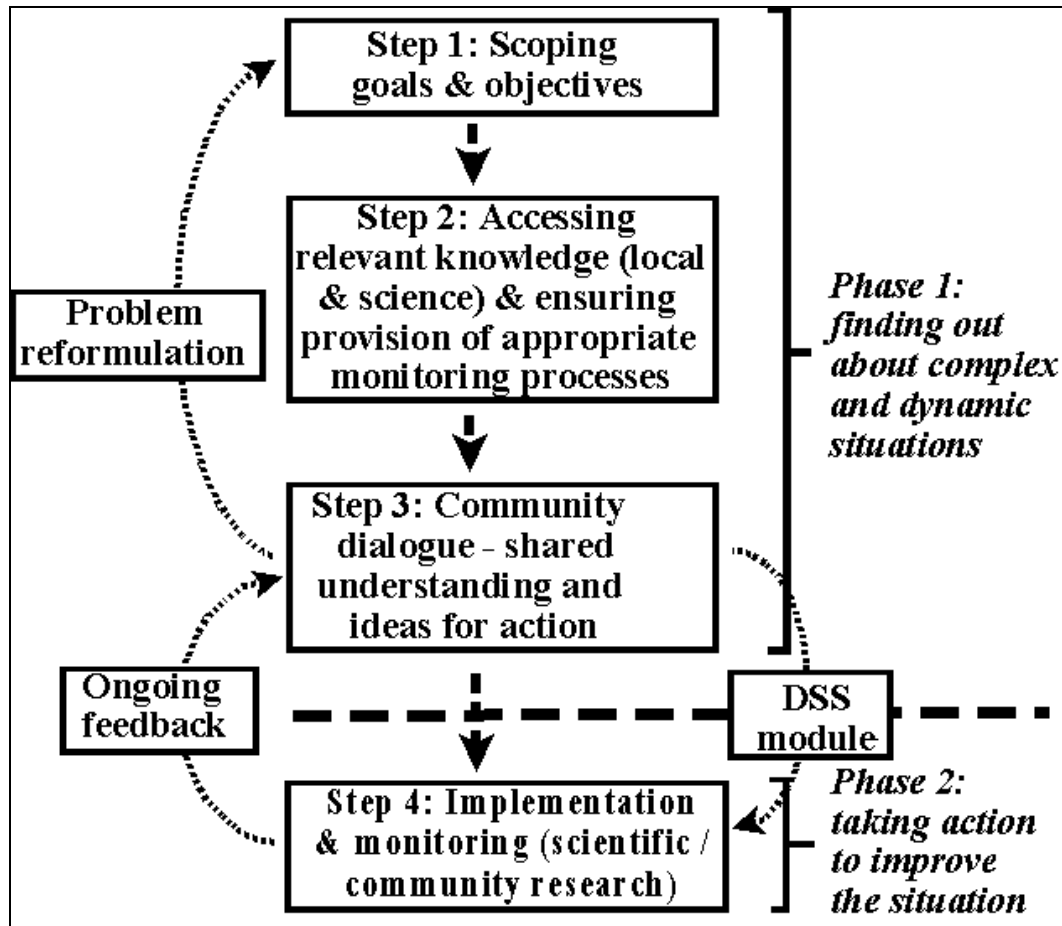
Figure 9. The Integrated System of Knowledge Management (ISKM) framework (Allen et al., 1998).

With the variations of social perception on various agricultural and environmental situations, step 3 aims to "actively support improved communication flows among all those involved to develop the 'useful knowledge needed to provide practical decision support". This is facilitated through workshops that provide a learning environment for participants to share knowledge and to understand how other individuals see the world. Involvement in the participatory process of the monitoring and adaptive management step (step 4) allows land managers to be able to gain technical expertise on the local and scientific knowledge of their physical environment. The research process in step 4 can also help scientist and community members determine any knowledge gaps and determine new research initiatives.

In a study conducted by Wu and Haasis (2011), KM was used as an aid to address sustainable development in the logistics industry, in particular in Freight Villages (FV). According to Wu

and Haasis (2011), a freight village (FV) is a "special intermodal hub (nodal point) in the transportation system, including different logistics facilities, where separate operators are providing number of services, connected to transportation, logistics and distribution in established geographical coverage"(Wu and Haasis, 2011, pg. 1). Wu and Haasis (2011) identified two knowledge flows in the context of a sustainability-oriented FV. They are internal knowledge flow and supportive knowledge flow. (See Appendix 3). A mode of interacting processes is presented to show how KM can improve the sustainability level of a business organization. See figure 10 below.

Gloet (2006) explores the linkages between Knowledge Management (KM) and Human Resource Management (HRM) as a means of developing leadership and management capabilities in order to support economic, social and environmental forms of sustainability. Gloet (2006) does this by linking KM and HRM in order to revitalize HRM functions in four areas: roles, responsibilities, strategic focus, and learning focus. With respect to changes in roles, Gloet (2006) alludes to the premise that the knowledge economy will require new sets of roles that can sustain and assist organizational capabilities. The new HRM roles include knowledge facilitator, relationship builder, and the rapid deployment specialist. These human capital stewards should be able to acknowledge the value of human intellectual capital and ensure human capital within the enterprise is effective, available, and will grow in value. The roles of the knowledge facilitator would be on learning
 and development, management of knowledge (assuring that conducive environment exists for knowledge capturing), sharing, and dissemination. The role of the relationship builder would be to sustain networks and communities of practice, bringing together people in various parts in the supply chain. The rapid deployment specialist faces the challenge of rapidly changing markets, where information, business processes, and organizational design can be joined in varying ways in order to meet the changing dynamics in the knowledge economy.
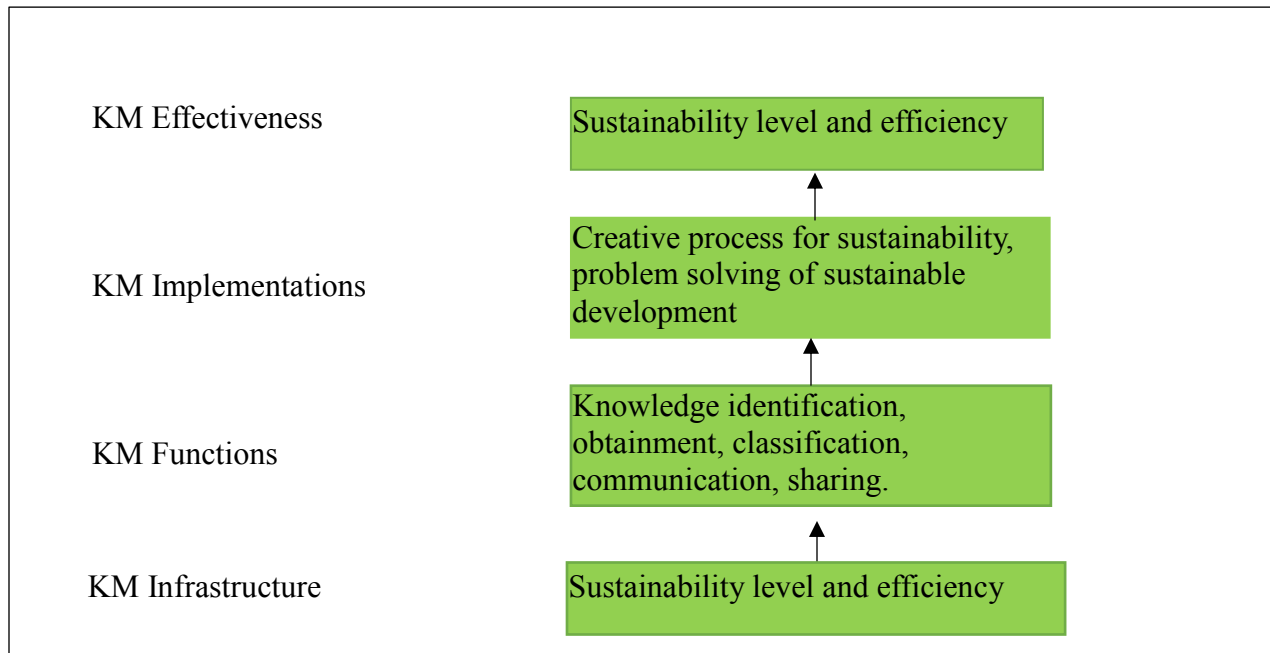
Figure 10: Improving sustainability level based on Knowledge management. At the basis, the Knowledge Management (KM) infrastructure provides the tools to be able to identify, obtain, classify, communicate and share knowledge. Such KM functions enable creative processes for sustainability goal and help in solving problems in the process of sustainable development. By means of KM implementation, the sustainability level and efficiency of an organization are achieved consequentially. These interacting processes make KM functions on sustainability effective (Wu and Haasis, 2011).

According to Gloet (2006), HRM should "reflect a responsibility for developing and sustaining organizational capabilities through activates that overlap with traditional business functions such as strategy formulation and implementation, finance and marketing as well as new function such as KM" (Gloet,2006, pg. 406). This will require relationships to be built across the supply chain (i.e. relationships with employees, mangers, customers, suppliers and distributors).

In the knowledge economy, HRM professionals should be able to "identify and channel intellectual capital toward the development of a concise set of core competence, strength and capabilities" (Gloet, 2006, pg. 406). Long term strategic development should be complimented with a short term strategic focus that is responsive to unpredictable circumstances. Organizations should also be renewing and revitalizing their long-term sustainability goals. HRM in the knowledge economy should be able to have a learning focus where learning environments are created to encourage knowledge creation, sharing, dissemination, and the fostering of communities of practice.

Authors, namely, Mirghani et al. (2009) and Lwoga et al. (2010) empirically evaluate the application of knowledge management to achieve sustainable capacity in varying industries or cases using surveys, non-participant observation, semi-structured interviews, and focus groups. Further descriptions of their studies are presented below.

A study conducted by Mirghani et al. (2009) empirically assesses the significance of knowledge management for sustainable development using surveys and interviews among KM/integrated information and communication technologies. The survey was conducted in developing countries since developing countries are in high demand for the application of knowledge concepts through IICTs. Developed countries were not chosen, as they already have existing infrastructures and have transitioned into a knowledge economy where service business models are shaping sustainability.

Their first hypothesis, which states that KM does not significantly contribute to sustainable development was rejected since the majority of respondents came to the agreement that knowledge is important to the foundations of sustainable development. The rationale behind this can be explained as follows; sustainable development activities depend on the mobilization of knowledge across geographic regions and the sharing of that knowledge between different development partners. On the other hand, one of KM principal objectives is to expand the scope of the experiential context through sharing knowledge across time, space and geographical boundaries. The more sharing of knowledge, the higher the likelihood that there would be more returns from that knowledge and the more insight developed into it (Ismail and Fakir, 2004; Spekman et al., 2002; Hurwitz et al., 2002).

Organizational knowledge sharing in a sustainable development organization can be classified in two modes: intra-organization sharing for domestic knowledge and inter-organization sharing for exotic knowledge. IICTs improve the quality of shared decision making in both inter- and intra-organizational settings. The improvement of decision-making as a result of IICTs in sustainable development organizations is as a result of the "increase in the capacity of analytical process, amount of information, just-in-time knowledge, and ease of communication for sharing ideas" (Mirghani et al., 2009, pg. 279).

Lwoga et al. (2010) on the other hand sought to evaluate the application of knowledge management (KM) tools in managing indigenous knowledge (IK) for sustainable agricultural practices in developing countries, with a specific focus on Tanzania. In their study, non-participant observation, semi-structured interviews, and focus groups were used to collect data from small-scale farmers in the selected study sites. In total, 181 farmers participated in the semi-structured interviews and 12 focus group discussions were carried out in the selected study sites. The study looked at the application of KM models (such as the SECI model by Nonaka and Takuechi) in managing IK for sustainable agricultural practice in the local communities (Lwoga et al. 2010). (For more information on the SECI model, please see figure 2). The motive behind the research centers on the notion that there is a need to manage indigenous knowledge (IK) of the local communities in developing countries such as Tanzania, Uganda, and Mali. IK is utilized as the basis for local decision making in natural resource management, agriculture, and healthcare, just to name a few areas.

IK is commonly used to improve the agricultural performance in African countries. Many African countries rely on the agricultural sector as the backbone for their economy (In Tanzania, 25.7% of the gross domestic product [GDP] related to agriculture provides 30.9% of exports and employs 70% of the work force). In countries like Tanzania, low agricultural growth rates contribute to the slow reduction of poverty and hunger. According to the United Nations Development Program (2003), effective management and usage of knowledge for competitive resource development can lead to growth in the annual rate of food production *per capita* to at least 4%, and the real economic growth rate to at least 7% without further damaging the environment. Nevertheless, IK is starting to gradually disappear from most African countries, including in Tanzania, without any efforts to manage the dissipation. IK is normally passed down from one generation to the next via oral tradition or demonstration, and not uniformly shared across communities because of issues related to power relationships and cultural differences. The use of knowledge management practices can enhance the management of IK in local communities, but many KM approaches are used to support business's competitive advantage in the developed world. Many have argued that KM should look beyond supporting business systems in Canada, America, the UK, Netherlands, and should be adopted by developing

countries in their local practices for development agendas. The research conducted by Lwoga et al. (2010) highlights this by assessing the applicability of the SECI model by Nonaka and Takuechi in managing IK to improve agricultural practices in local communities in Tanzania.

Findings from the study show that some KM practices were utilized by the local communities to improve their management of IK (e.g. 86% of farmers applied IK received from tacit knowledge to the farming systems). However, for IK to be beneficial for agricultural development, existing KM practices should be strengthened. From the utilization of the SECI model, it was found that most farming knowledge is created by the conversion of tacit to explicit knowledge and vice versa. The findings also revealed that IK is mainly tacit in nature, so physical communication is imperative in enabling the creation and sharing of knowledge: this is why the externalization and combination stages of the SECI model was partially fulfilled. Additionally, farmers internalize knowledge from tacit sources in contrast to explicit sources (such as print formats). Thus, the internalization stage of the SECI was partially fulfilled. As a whole, the study showed that the SECI model could be used to manage IK. However, communities should be placed in knowledge creating settings, whereby knowledge is continuously created, shared, and managed within and outside its boundaries. Lwoga et al (2010) concluded their paper with recommendations for the application of KM tools for better management of IK and its integration with other knowledge systems for agricultural development in developing countries, including Tanzania.

2.11 Gaps in Literature

In relation to work conducted on KM with respect to the mining industry, Harkonen and Rutenberg (1993) provide a framework whereby external learning (through formal collaboration, informal collaboration, reverse engineering, and external shocks) can ignite internal corporate learning and lead to continuous productivity, improvement, and innovation throughout the organization. Nevertheless, no attention has been given to how sustainability knowledge in the mining industry can be effectively managed through an integrated KM cycle for effective decisions making in a sustainability context. Furthermore, to the best of our knowledge, there exists no literature on recommendations to better manage sustainability knowledge in the mining industry. This thesis addresses these gaps.

2.12 Theoretical Framework

An integrated knowledge management cycle as proposed by Dalkir (2011) will be explored in the context of developing questions for a semi -structured interview to assess how sustainability knowledge is captured, disseminated and applied within mining organizations.

The integrated knowledge management cycle is a synthesis of 4 KM cycles, namely: Meyer and Zack (1999), Bukowitz and Williams (2000), McElroy (1999), Wiig (1993). (See appendix 4 for a detailed overview of the KM cycles as explored by Meyer and Zack (1999), Bukowitz and Williams (2000), McElroy (1999), Wiig (199)). A synthesis of the four KM cycles is shown in Table 5.

Meyer and Zack(1999)	Bukowitz and Williams(2000)	McElroy(1999)	Wiig(1993)
Acquisition	Get Use Learn Contribute	Individual and Group learning Knowledge claim validation Information acquisition	Creation Sourcing Compilation
Refinement	Assess	Knowledge validation	Transformation
Store/retrieve Distribution Presentation	Build/Sustain Divest	Knowledge integration	Dissemination Application Value realization

Table 5: A synthesis of the 4 KM cycles, Meyer and Zack (1999), Bukowitz and Williams (2000), McElroy (1999), Wiig (1993). Source: Dalkir (2011)

The four KM cycles were chosen on the basis of meeting the following 3 criteria: (Dalkir, 2011)

a) They were implemented and validated in real world settings
b) They are comprehensive with respect to the different types of steps found in the knowledge management literature
c) They included detailed descriptions of the knowledge management processes involved in each steps.

While the authors use different labels to describe each of the KM cycle stages, they generally refer to the same general type of knowledge processing.

Table 6 shows an amalgamation of major KM cycles and what they had in common with each other and additional steps that were contributed by each of the cycles (Meyer and Zack (1999), Bukowitz and Williams (2000), McElroy (1999), Wiig (1993)), providing a comprehensive overview of knowledge processing throughout the organizational lifecycle of knowledge (Dalkir, 2011).

Steps in common	Steps added by	Major Stages (Dalkir, 2011)
1. Knowledge capture		Knowledge capture and/or creation
2a. Knowledge creation		
2b. Knowledge contribution	Bukowitz and Williams (2000)	
2c. Knowledge filtering and selection	Bukowitz and Williams (2000)	
3a. Knowledge codification		
3b. Knowledge refinement	Meyer and Zack (1999), Bukowitz and Williams (2000)	
4a. Knowledge sharing		Knowledge sharing and dissemination
4b. Knowledge access		
4c. Knowledge learning	Bukowitz and Williams (2000)	
5a. Knowledge application		Knowledge acquisition and application
5b. Knowledge evaluation	McElroy (1999) Bukowitz and Williams (2000)	
6a. Knowledge reuse		
6b. Knowledge reuse and divestment	Bukowitz and Williams (2000)	

Table 6: Synthesis of knowledge processing steps contributed by each of the approaches (Dalkir, 2011)

The integrated KM cycle mentioned by Dalkir (2011) subsumes most of the steps in the KM cycles explored by Meyer and Zack (1999), Bukowitz and Williams (2000), McElroy (1999), Wiig (1993) and classifies them into three major stages: (Dalkir, 2011)

1. Knowledge capture and /or creation
2. Knowledge sharing and dissemination
3. Knowledge acquisition and application
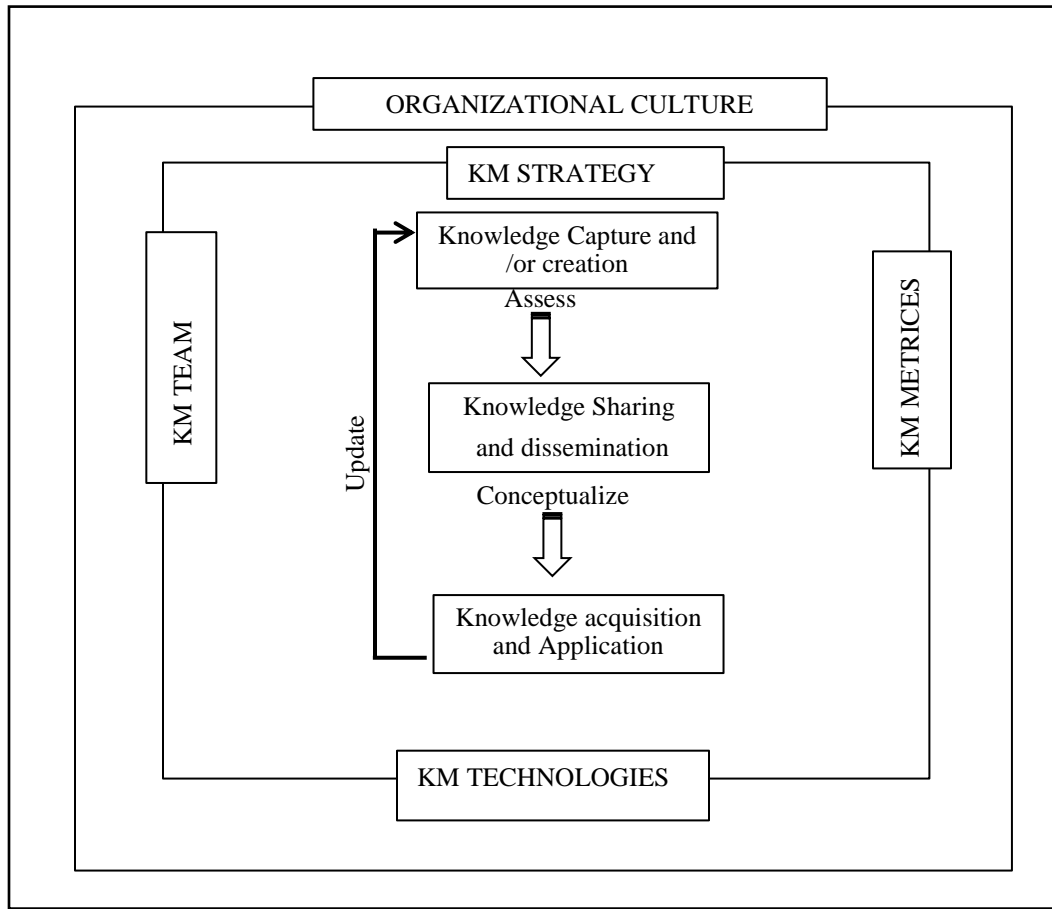
Figure 11: An integrated KM cycle(Dalkir, 2011).

2.13 Knowledge capture and/or creation

Knowledge capture is the first high-level phase of the knowledge management cycle as seen in figure 11.

Knowledge capture or creation may be performed by individuals who have designated roles within their firm to perform this duty, by groups of employees within the firm, by all members of a community of practice (CoP) or even by a dedicated CoP individual (Dalkir, 2011). It can also be performed on a personal level, i.e. almost everyone performs some knowledge creation, capturing and codification activities within their role in a firm. Cope (2000) referred to this as the Personalizing of Knowledge Management (PKM). While Dalkir shows from figure 12 that all

knowledge can be captured and qualified, this is sometimes not the case. Grant (2007) accentuates on this, when he discusses Polanyi's (1958) work on tacit knowledge. According to Grant (2007), with the appropriate use of language, much, perhaps most, but probably not all, of this knowledge can be shared between individuals who share a mutually agreed language. When the tacitness predominates so that articulation cannot be expressed in language, Polanyi calls this "ineffable" knowledge.

2.13.1 Tacit knowledge capture at the individual and groups level

According to Dalkir (2011), the capturing of knowledge may be difficult, especially in the case of tacit knowledge. Tacit knowledge management is the process of capturing the experiences and thoughts of employees within a firm and making it accessible to a wider audience (or anyone who needs it). Capturing tacit knowledge at the individual and group level involves a number of key steps. Dalkir (2011) highlights this in figure 12 where knowledge identification involves characterizing what valuable knowledge within an organization would be worthwhile to capture. Conceptualization refers to the specification of the key concepts and relationships in the form of a concept/knowledge map. Codification on the other hand refers to the rendering of the validated tacit knowledge into a more explicit form that can be easily disseminated throughout the organization or department.
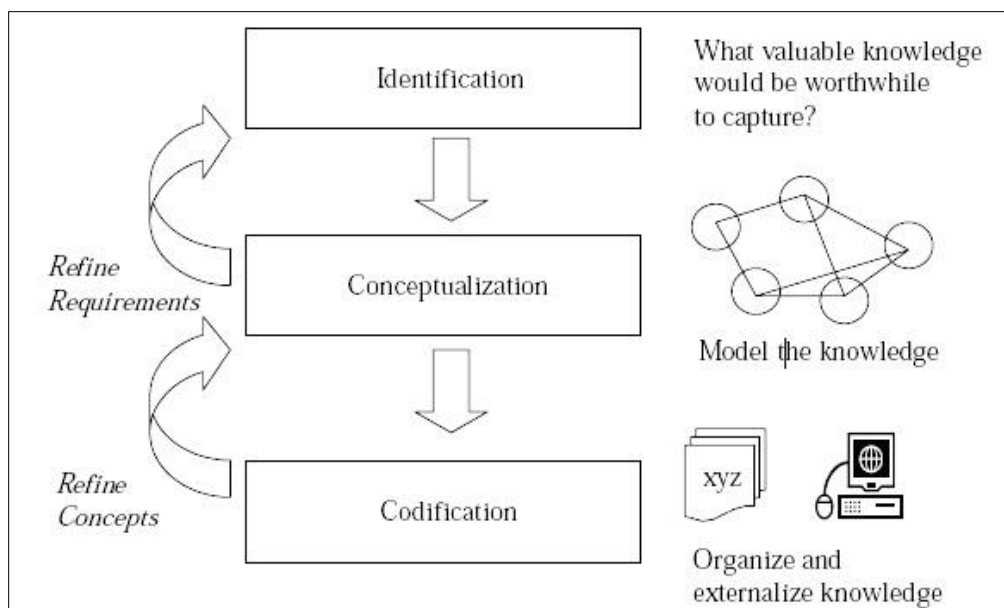
Figure 12: Knowledge acquisition phases (Dalkir, 2011).

Parsaye (1988), an artificial intelligence researcher outlines three major approaches to tacit knowledge acquisition from individuals and groups: interviewing experts, learning by being told and learning by observation.

Interviewing experts through structured interviews is a common technique utilized to render key tacit knowledge of individuals into a more explicit form that is organized, indexed, documented and easily accessible. In many organizations, structured interviews (through open/closed-ended questions) are done through exit interviews that are held when knowledgeable employees are about to leave the company or near retirement age. Structured interview techniques place a great deal of demand in one being highly skilled in communicating and conceptualizing, as well as in having a good knowledge base of the subject at hand.

In learning by being told, the interviewer expresses his knowledge, and the interviewer or knowledge manager on the other hand clarifies and validates this knowledge, rendering it into a more explicit form.

Learning by observation involves watching an expert show what he knows in person, or via audio-visual means. Certain kinds of knowledge can sometimes be difficult to explain or explicate, but can be made clear when one watches an expert work. This approach involves presenting the expert with a sample problem, scenario or case study that the he then solves.

    2.13.2 Tacit knowledge capture at the organizational level
According to Dalkir (2011), at the organizational level, tacit knowledge acquisition is qualitatively different from those that occur at the individual and group levels. At the organizational level, knowledge capture takes place at a macro level, while we are mostly concerned about identifying and coding valuable tacit knowledge at a micro level when it comes to individuals and groups. At the organizational level, Malhotra (2000) gives an approach with four processes to capture knowledge. They include grafting, vicarious learning, experiential learning, and inferential processes.

Humber (1991) states that grafting is a process that involves the migration of knowledge between firms, whereby one firm's store of knowledge increases by gaining access to task or process specific knowledge that was not previously available to it. This process can be achieved through mergers, acquisitions or direct knowledge passing between firms. When it comes to acquiring complex forms of knowledge, grafting is deemed to be faster than other forms of knowledge acquisition, such as acquisition through experience and acquisition through imitation. Humber (1984) and Drucker (1988) allude to the premise that we can expect that as the rate at which organizations assimilate new knowledge increases, grafting will be more frequently used by organizations to acquire new knowledge quickly.

Dalkir (2011) mentions that vicarious learning, also known as observational learning, occurs when one firm observes another firm's techniques or procedures. In other words, vicarious learning deals with how people learn from watching other people learn e.g. benchmarking studies where companies adopt best practices of other industry leaders. The knowledge gained through vicarious learning is more tacit in nature (as compared to grafting) as it involves knowledge of know-how (Inkpen and Beamish, 1997; Dalkir, 2011).

According to Dalkir (2011), experiential knowledge involves knowledge that is created by doing and practicing. This type of knowledge is initially tacit but can be easily codified and transferred (Pennings, Barkema, and Douma, 1994; Starbuck, 1992). Argyris and Schon (1978) refer to the processes of single- and double-loop learning. Single-loop learning involves the refinement and improvement of existing procedures and technologies as opposed to developing new ones (adaptivity for efficiency)(Dalkir, 2011). An example of experimental knowledge is learning how to ride a bike, a process that can illustrate the widely known four-step experiential learning model (ELM) as purported by David A, Kolb, an American educational theorist (Kraft, 1994). (See figure 13 below). Following the bike-riding example, in the "concrete experience" stage, the learner physically experiences the bike in the "here-and-now"(Kolb 1984). This experience forms "the basis for observation and reflection" and the learner has the opportunity to consider what is working or failing (reflective observation), and to think about ways to improve on the next attempt made at riding (abstract conceptualization) (Kolb 1984). Every new attempt to ride is informed by a cyclical pattern of previous experience, thought and reflection (active

44

experimentation) (Kolb 1984). In inferential processes on the other hand, learning within an organization occurs through interpretation of events, states, changes and outcomes relative to the activities undertaken and decisions made (Mintzberg, 1990).
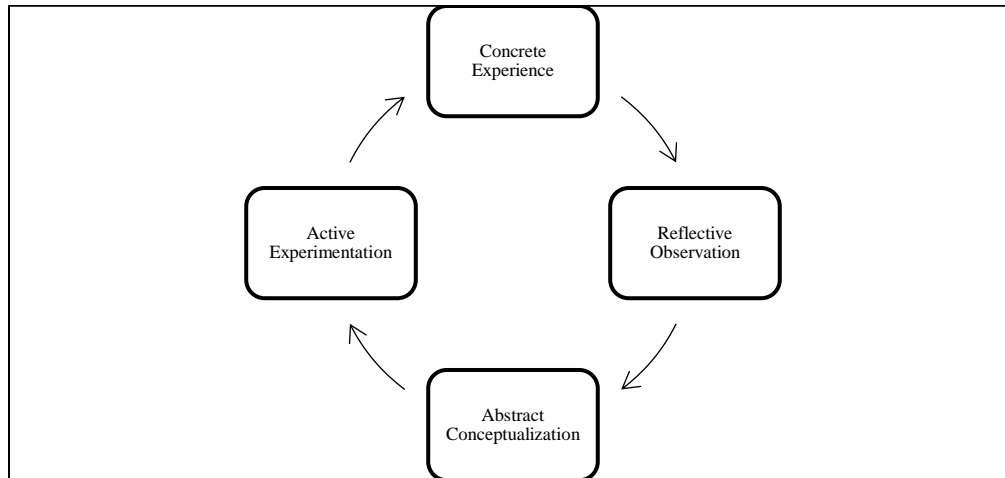
Figure 13: David Kolb's Experiential Learning Model (ELM) (Kolb 1984)

2.13.3 Recommended KM practices at various stages of Projects

Srikantaiah, et al (2010) shows some of the recommended KM practices that can be employed in the various stages of a project.
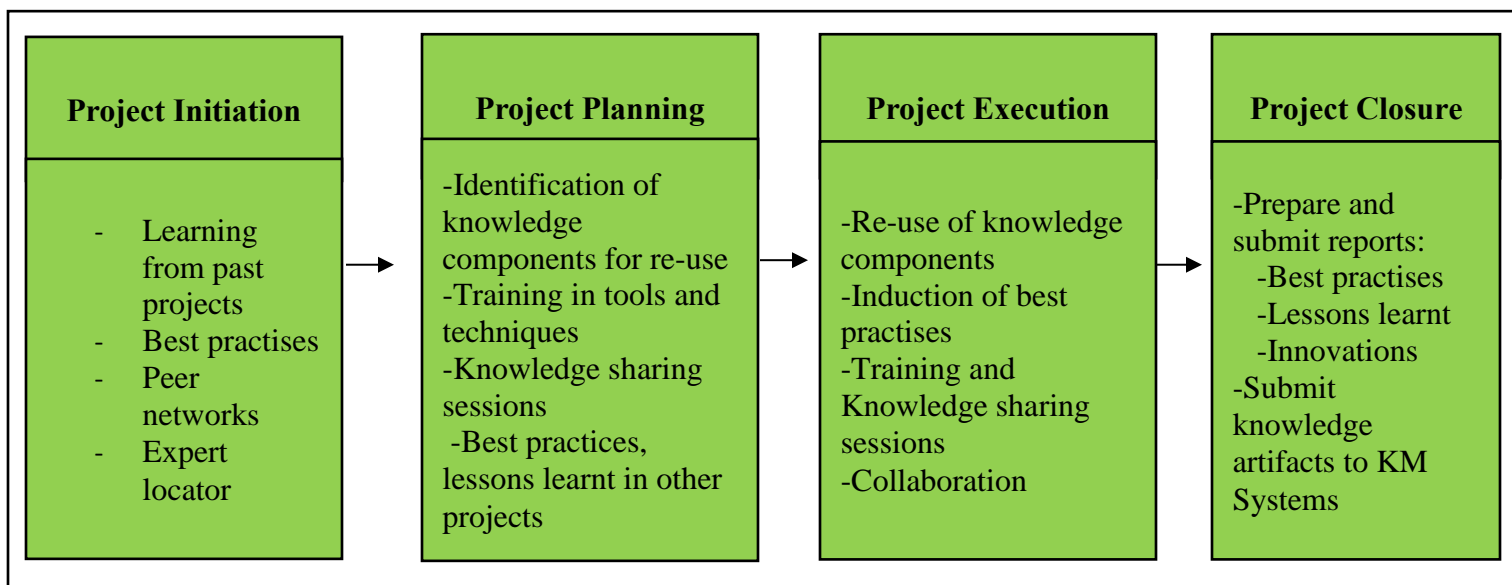
Figure 14: Recommended KM practices at various stages of projects (Srikantaiah et al., 2010).

2.13.4 Managing knowledge loss

Departing employees carry with them key knowledge that is often important to a firm's capabilities, which may be a key source of best practices. Most organizations are starting to experience a high turnover rate as a result of retiring staff. Parise, et al (2006) expresses this concern by stating that in terms of broad demographics, nearly 20% of Americans holding executive and managerial positions were set to retire in 2008.

A negative side effect of the loss of knowledge through human resource attrition is the dissipation of intellectual knowledge or knowledge resources that could be valuable to a firm. General Mills Inc., for example, estimated that the departure of one experienced marketing manager could cost the firm millions of dollars in terms of loss in critical marketing and client knowledge (Paruse et al. 2006). Most forward-thinking organizations have taken action in terms of preventing such loss of knowledge from retiring operations staff and other turnover.

2.14 KNOWLEDGE SHARING AND LEARNING

Once knowledge has been captured, it needs to be disseminated throughout the organization (see figure 11). Before sharing the knowledge captured, the next critical step must be some form of selection criteria (assessment) that will closely follow the organizational goals (Dalkir, 2011). Organizations need to ask themselves whether the content captured is valid or whether it is of sufficient value to the organization that it should be added to the store of intellectual capital (Dalkir, 2011).

2.14.1 Sharing of sustainability knowledge through Communities of Practice (CoP)

Knowledge sharing occurs more effectively and efficiently in a community of practice (CoP). A community of practice can be defined as a group of people, together with their shared resources and relationship dynamic, who come together to make use of shared knowledge in order to enhance learning and create a shared value for the group (Seufert, VonKrogh, and Bach 1999: Adams and Freeman 2000).

The term CoP originated from Lave and Wenger (1991). According to Wenger (1998), a CoP defines itself along three dimensions, which are related to practice itself. First, members interact with one another, further establishing relationships through mutual engagement. Second, members are bound by an understanding of a sense of joint enterprise (Wegner, 1998). Third, members produce a shared repertoire. "The repertoire of a community of practice includes routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions, or concepts that the community has produced or adopted in the course of existence"(Wenger, 1998, p. 83)

Key characteristics of a community of practice (CoP)
• Sustained mutual relationships – harmonious or conflictual
• Shared ways of engaging in doing things together
• The rapid flow of information and propagation of innovation
• Absence of introductory preambles, as if conversations and interactions were merely the continuation of an ongoing process
• Very quick setup of a problem to be discussed
• Substantial overlap in participants' descriptions of who belongs
• Knowing what others know, what they can do, and how they can contribute to an enterprise
• Mutually defining identities
• The ability to assess the appropriateness of actions and products
• Specific tools, representations, and other artifacts
• Local lore, shared stories, inside jokes, knowing laughter
• Jargon and shortcuts to communication as well as the ease of producing new ones
• Certain styles recognized as displaying membership
• A shared discourse reflecting a certain perspective on the world

Table 7: The characteristics of a community of practice (Wenger, 1998, pg. 125–126)

2.14.1.1 Limits and weaknesses of CoP's

Roberts (2006) explores the limits and weakness of CoP. Some of the limitations explored by Roberts (2006) are as follows:

Power. Communities of practice will constitute of members that of varying authority, experience, personality and so on (Roberts, 2006). The power of an employee may be evident in terms of the degree of participation, i.e. employees who have full participation may be the ones likely to wield more power within their organization (Roberts, 2006). An organizations power structure may be reflected in the power relations within its own CoP (Roberts, 2006). E.g. In decentralized organizations, where power is distributed, one might observe a greater diversity of voices form all employees, which is to say that there would be a greater variation in the collection of knowledge created and shared between employees. In hierarchical organizational structures, where power is centralized, negotiation would sometimes be limited to employees with senior authority, sometimes muting other members of the community (Roberts, 2006). CoP alternatively has the potential to provide a space free from power structures evident in hierarchical organizational structures, offering a space for experimentation and creativity (Roberts, 2006).

Trust. In a CoP without trust, members may be hesitant to share information. According to Roberts (2006), "trust, familiarity and mutual understanding, developed in their social and cultural contexts, are prerequisites for the successful transfer of tacit knowledge" (Roberts, 2006, pg. 628). There is empirical evidence that shows that trust leads to greater level of openness between co-operative partnerships, therefore facilitating effective knowledge transfer (Wathne et al., 1996).

2.14.2 Technologies and techniques to share sustainability knowledge

There are a wide variety of techniques and technologies (KM tools) that can be utilized to share sustainability knowledge in the mining industry. Many KM authors use the term "tools" to refer solely to IT tools. However KM tools can refer both to IT and non-IT tools. In this study we distinguish between KM techniques/tools that are non-IT oriented and KM techniques/tools that are IT oriented. Some of the main differences between KM techniques and KM technologies are presented in table 8.

KM TOOLS	
KM techniques	**KM Technologies**
- Require strategies for learning - More involvement of people - Affordable to most organizations - Easy to implement and maintain - More focus on Tacit knowledge Example of tools: - Brainstorming - Communities of practice - Face to face interactions - Recruitment - Training	- Require IT infrastructure - Require IT skills - Expensive to acquire/Maintain - Sophisticated implementation/maintenance - More focus on explicit knowledge Example of tools: - Data and text mining - Groupware - Intranets/Extranets - Knowledge bases - Taxonomies Ontologies

Table 8: KM tools: A comparison between the techniques and technologies (Al-Ghassani, 2002).

2.14.3 The flow of knowledge within projects -learning before, during and after

According to Milton (2005), team members in a project can learn at the start of a project so that it can begin from a state of complete knowledge. Team members can also learn during a project so that plans can be changed and adapted as new knowledge becomes available. Finally, team members in a project can learn after a project so that knowledge in the form of lessons learned and best practices are captured for future use. During each of the learning stages (learning before, learning during, and learning after), communities of practice need to be established in order to manage knowledge assets and to own the tacit knowledge. Additionally, knowledge roles need to be established in the projects in order to ensure that knowledge management is embedded in the business activity. Figure 15 shows the learning before, during and after model according to Milton (2005).
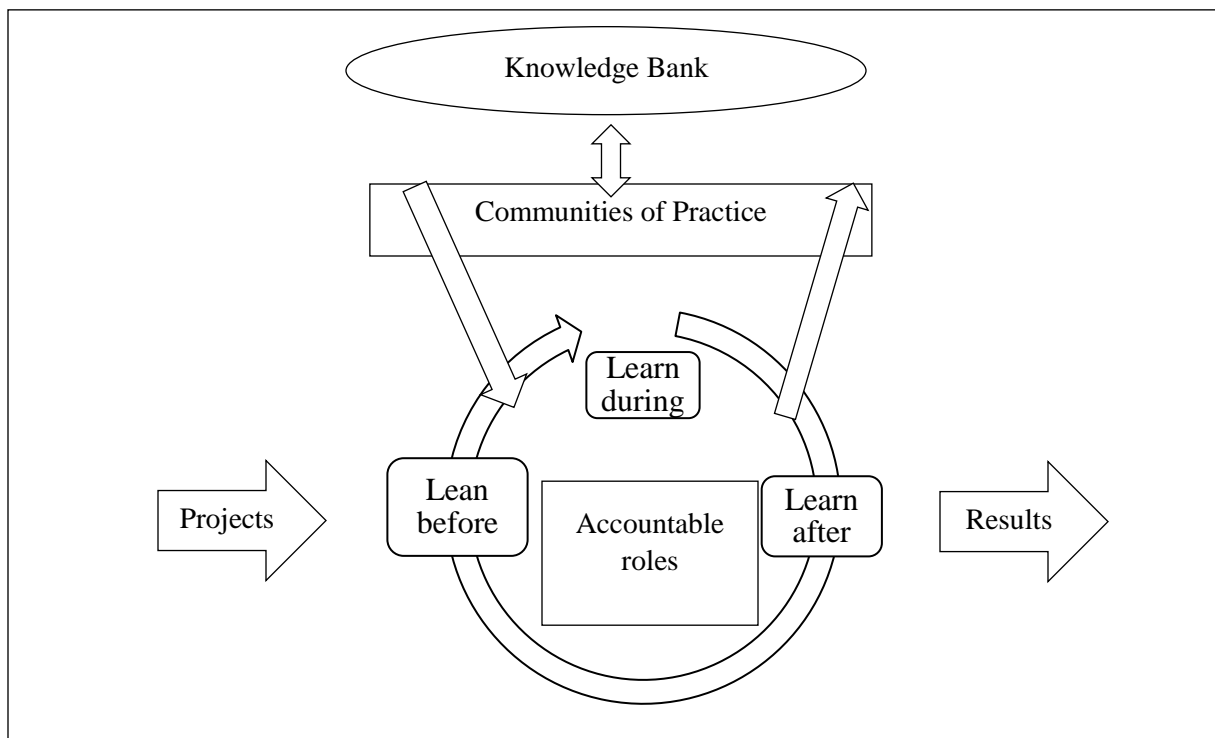
Figure 15: The learning before, during and after model (Milton, 2005).

Milton (2005) offers various learning activities that could be used before each of the key project stages (See figure 16) and subsequent explanations below. All of these learning activities can be applied to sustainability projects in the mining industry.
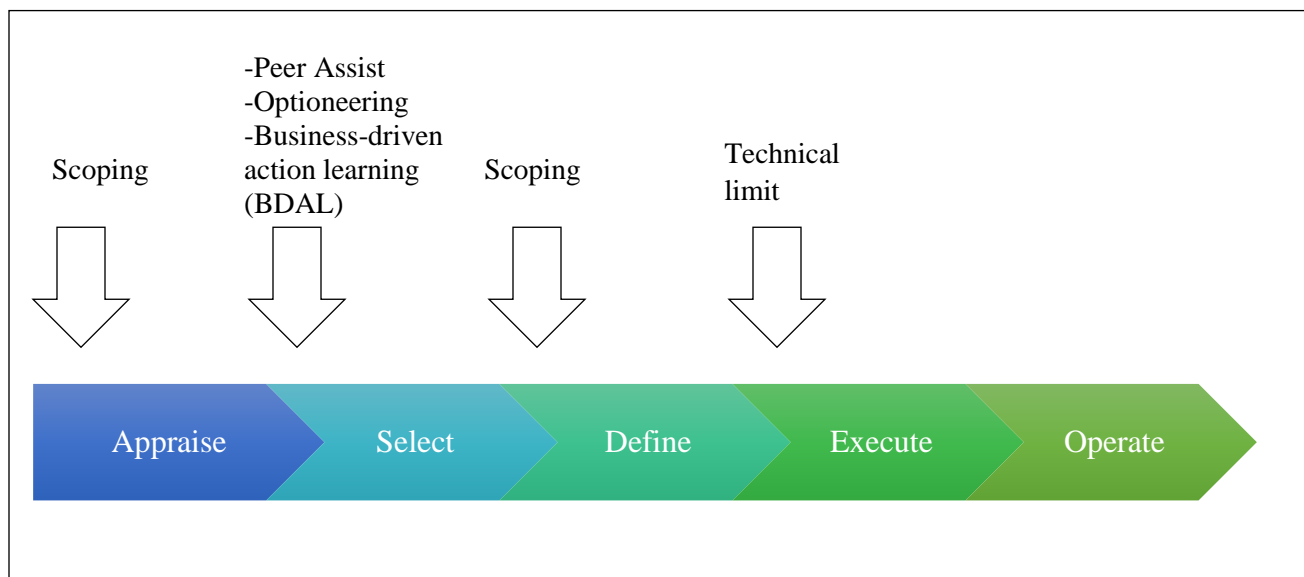
Figure 16: Potential learning before activities in the project stages (Milton 2005).

2.14.3.1 Learning before in the scope/appraise stage

The first stage of a project involves understanding the problems that need to be resolved. A project team working on a sustainability project or any other project needs to understand the customer's needs and aspirations. Additionally, all parties need to understand the constraints [environmental, legal and technological, under which the project will occur]. Scoping meetings (also known as right scoping, alignment or objective-setting meetings) are intended to make sure that both the project team and the customer understand the purpose of the project and the strategic value of the organization.

2.14.3.2 Learning before in the concept select/concept design stage

Once a project team gains sufficient knowledge of the problem that needs to be addressed, in addition to the needs of the customer, then the project team can go on to select the right option for project delivery. Team members will need to know how best to tackle this sort of project. They will want to know information about,

   a) Who has gone through a similar project and how successful were they?
   b) What options have been tried in the past?
   c) How successful and unsuccessful were hose options?
   d) What is the best option for the team going forward?
   e) What risks and opportunities will this option bring?

This knowledge can be brought into the project using the following techniques:

   a) Peer assist is a technique utilized by project teams in order to solicit expertise on a subject matter regarding an issue that the team may be facing (Young, 2010). The advantage of using peer assist is that it shortens the learning curve of the project team, as teams sometimes struggle to solve complex problems based on their existing knowledge or resources (Young, 2010). Peer assist also helps project teams to engage with project issues with outside expertise (Young, 2010). Milton (2005) highlights three important factors that are important for the success of peer assists:

1) The peer assist needs clear objectives. The clearer one can be about the purpose, the more likely it is that the peer assist will deliver value.

2) The project team that is receiving assistance from the peer assist should be willing to learn, and the peers need to be willing to share their knowledge and experience (Milton, 2005). If the meeting falls into "attack and defend" behaviors from individuals, then it has failed its purpose.

3) The peer assist should involve relevant peers. It's more effective to have project managers and team members from previous projects who have valuable experiences to share (Milton, 2005). According to Milton (2005), "People are far more open to learning from, and sharing with their peers and this removes all the politics associated with management hierarchies" (Milton, 2005, pg. 50).

b) Optioneering is one form of peer assist that can be utilized to develop and rank a list of options or conceptual designs for a project (e.g. best tailing management approach) (Milton, 2005). Optioneering involves sessions of facilitated brainstorming as well as the checking of options against the value and objectives of the project.

c) Business Driven Action Learning (BDAL can be used to bring new knowledge and innovation into a project. Specifically, in BDAL, team members engage in a program of collective knowledge gathering via learning from other parts of the business or learning from what the competitors are doing. For instance, when BP was building its first western type petrol station in Japan, it spent some time going around to competitor sites to observe what issues the competitors were facing, and how they dealt with these issues.

2.14.3.3 Learning before the define/design stage

In the define/design stage, the project team should have looked at all conceptual project options and selected the best option to proceed with. The team will require knowledge about how to design and implement the project. They will need to scope out what the end project will look like, what the benchmark performance is in terms of cost, time, quality and safety, and what sort of performance the team should aim for—that is, what the risks are and how to address them .Once again, this knowledge can be brought using peers assists, BDAL, and technical limits.

2.14.3.4 Learning before the execute/construct phase

Knowledge that is needed before the execution stage is very practical in nature. This knowledge will normally come from "ground workers" or previous project teams. One method of learning before the construction phase is through the use of technical limits. Technical limits as it is known at BP, or "drilling the limit" as it known by Shell, has been recognized to deliver tremendous value to the oil industry. The concept of technical limit involves using the knowledge of the drilling crew to perfect drilling plans. Oil companies such as BP and Shell would prepare drilling plans in the design/define stage and this would be passed to the drilling crew, which would do the drilling in the execution stage and who possess knowledge of how the work can best be done. By involving the drilling crew before the execution stage, oil companies can not only access valuable knowledge, but also build better plans.

Technical limits could be applied to sustainability related work. For instance, when it comes to the construction of effective mine tailing plans, valuable knowledge from crew members constructing the tailing facilities could contribute to formulating better future tailing plans.

2.14.3.5 Learning during a project

Learning during a project will normally involve the capturing of new knowledge on a regular basis. It's important here that new lessons are discussed with the team members, and that new knowledge is sought and applied to the project to overcome any obstacles. Certain kinds of learning during a project include;

a) After action reviews (AARs). AARs are applied in a wide array of industries as a mechanism for learning during a project. AARs are focused review meetings that are short in duration, and are intended to help team members become conscious of their knowledge so they can act on that knowledge as the work progresses. In short, AARs are like learning on Monday to better perform on Tuesday. Communities of practices, lessons, and action logs can also be used to facilitate learning during a project.

2.14.3.6 Learning after a project

Learning after a project involves,

- Identifying new knowledge which has been learned by the project team;
- Identifying all existing knowledge which has been reinforced or validated by the project team; and
- "Recoding this knowledge for the sake of future projects"(Milton, 2005, pg. 67)

Retrospect and knowledge histories could be used to facilitate learning after a project.

2.14.4 Knowledge sharing barriers

Knowledge sharing is considered to be one of the most important cornerstones in a company's knowledge management strategy (Riege, 2005). Despite the importance of knowledge management sharing practices for organizations and market performance, some barriers do exist that can hinder knowledge sharing within organizations, making it difficult for KM to achieve goals and to deliver a positive return on investment (Riege, 2005).

Riege (2005) classified obstacles to knowledge sharing into three categories:

- At the individual or employee level, knowledge sharing barriers are allied to the following factors: lack of communication skills and social networks, differences in natural cultures, overemphasis on position statuses, and a lack of time and trust.
- At the organizational level, barriers are associated with the economic viability, lack of infrastructure and resources, the accessibility of formal and informal meeting spaces, and the physical environment.
- At the technological level, barriers are associated with factors such as the unwillingness to use applications due to a mismatch with need requirements, unrealistic expectations of Information Technology (IT) systems, and difficulties in building, integrating and modifying technology-based systems.

2.14 .5 KNOWLEDGE APPLICATION

Knowledge application refers to the use of knowledge that has been captured/created and shared. If the knowledge application step is not accomplished successfully, then all the efforts to capture, code and share knowledge have been in vain, as KM can only succeed if the knowledge is

utilized properly. From figure 11, we can see that before knowledge is applied, it has to be contextualized in order to be understood (acquired) and used (applied) (Dalkir, 2011). According to Dalkir (2011), "contextualization implies identifying the key attributes of the content in order to better match to a variety of users; for example, personalization to translate the content into one preferred by the end user or the creation of a sort executive summary to better accommodate the time constraints of a senior manager"(Dalkir, 2011, pg. 54).

2.14.5.1 Knowledge Reuse

The process of reusing knowledge can be described in terms of the following stages: capturing or documenting knowledge; packaging knowledge for reuse; distributing or disseminating knowledge; and the actual reusing of knowledge (Markus, 2001). There are three major roles that are required in the reusing of knowledge process: the knowledge producer, the originator and documenter of the knowledge, who records explicit knowledge or makes tacit knowledge explicit, the knowledge intermediary who prepares knowledge for reuse by eliciting it, indexing it, sanitizing it, packaging it, and performing various roles in dissemination and facilitation; and the knowledge reuser, who retrieves, understands and applies the knowledge (Markus, 2001). These roles are not dictated or permanent roles, as it is expected that individuals will perform all three roles at some point during their work (Dalkir, 2011).

The 3 major steps of the integrated KM cycle (knowledge capture and /or creation, knowledge sharing and dissemination, and knowledge acquisition and application) are supported by an infrastructure of KM strategy, KM matrices, KM team, organizational culture and KM technologies to better help an organization manage knowledge effectively and efficiently.

2.15 ORGANIZATIONAL CULTURE

Culture has long been on the agenda for management theorists. Schein (1999), who's generally considered as the father of organizational culture, describes organizational culture as follows;

> 'Organizational culture is a pattern of basic assumptions –invented, discovered or developed by a given group as it learns to cope with its problems of external adaption and internal integration –that has worked well enough to be considered valid and, therefore to

be taught to new members as the correct way to perceive, think and feel in relations to those problems" (Schein, 1999, pg. 385).

In their book "The Character of a Corporation: How your companies culture can make or break your business," Rob Goffee and Gareth Jones (2000) propose a model of organizational culture laid out in the matrix in table 9 below.

	High Solidarity	Low Solidarity
High Sociability	Communal culture	Networked culture
Low Sociability	Mercenary culture	Fragmented culture

Table 9: Four types of organizational culture (Goffee and Jones, 2000)

Gofee and Jones (2000) use two dimensions to create the four types of organizational cultures. The first dimension, sociability, is a measure of friendliness in the organization. For example, the degree to which people might send birthday cards, etc. Solidarity, the second dimension, describes the degree to which people need to work together (despite personal disputes or conflicts) in order to get the job done. A high solidarity means that people can work together to achieve a common goal, even when they may have personal disputes or conflicts.

By being able to understand the culture of an organization, many managers, e.g. managers in the sustainability departments of mining firms, can be able to recruit the most suitable personality types to work for them. In addition, by underrating the varying cultures involved in an organization, managers can be helped to ensure that different units (e.g. sustainability unit, business unit, exploration unit) comprising of various cultures can work together effectively.

2.15.1 Relationship between organizational culture and knowledge sharing

Several authors stress the influence of organizational culture and knowledge sharing (e.g. Damodaran & Olphert, 2000; Davenport *et al.*, 1998; D. Ford & Chan, 2002; Hendriks, 1999; McDermott & O'Dell, 2001). Hendricks (2004) in figure 17 provides an analysis of a literature review that shows the relationships between culture and knowledge sharing.

A. conceptual relationships

A1. culture = knowledge

(knowledge is a component of culture; eg. Cleland,

A2. knowledge = culture

(understanding is shaped by cultural assumptions; eg. Schein, 1985)

relationships between culture and knowledge sharing

B. influencing relationships

B1. culture affects recognition of the value of knowledge

(a 'learning culture' values knowledge differently from a 'knowing culture'; McGill & Slocum, 1993)

B2. culture affects valuation of knowledge processes

(knowledge sharing is accepted if it fits 'the way we work'; McDermott & O'Dell, 2001)

B3. culture shapes how knowledge processes develop

(status differences may hinder knowledge sharing between functions; De Long & Fahey, 2000)

B4. culture shapes the organizational context of knowledge processes

(lack of vision and mission, as manifestations of culture, frustrate knowledge sharing; Davenport et al., 1998)

B5. culture determines the acceptance of knowledge management

(a learning culture needs management that 'lets a thousand flowers bloom'; Moss Kanter, 1996)

B6. culture affects the specification of KM interventions

(a CKO does not fit in a jeans culture; McDermott & O'Dell, 2001)

Figure 17: Classes of relationships between culture and knowledge sharing (Hendricks, 2004).

2.16 KNOWLEDGE MANAGEMENT ROLES

Knowledge management teams are vital to the success of any project in an organization (Robb, 2003). Organizing and managing a KM team is not an easy task. Robb (2003) in his study examines the experiences of companies both small and large that have erected a KM team as well as the consultants who aided them achieve true business value form their knowledge initiatives (Robb, 2003). According to Robb (2003), Ray Merrill, a consultant from Ariel Performance Systems Inc. (Fort Lauderdale, Florida), delineates six key functions that are significant to a KM team, they're as follows:

1. "Interface design lead - specializes in computer–human interaction and integration of content into work processes.
2. Training lead- specializes in knowing legacy content, cognitive needs, and learning strategies.
3. Technical architect-specializes in IT.
4. Business lead-specializes in understanding the measurable results to be obtained.
5. Organizational lead-specializes in the communication plan, motivational incentive, and other organizational needs for the project to be a success.
6. The "super-user"-a visionary user who can influence the user community, this person helps the system stay grounded in pragmatism" (Robb, 2003, pg. 38).

In small companies, some of these functions may be combined and in large companies or projects several individuals may be assigned to one or more functions (Robb, 2003).

When it comes to the specific skills required to carry out KM roles, the TFPL developed a KM skills map that was based on an extensive international search of over 500 organizations involved in implementing KM (Dalkir, 2011). TFLP is a specialist recruitment, advisory and research firm with offices in London, England, focuses on KM and Information Management consultancy Since 1987, TFPL has been working with organizations in both the public and private sector to help develop and implement knowledge and information strategies, and to help recruit and train information leaders and their teams. See Appendix 5 for an excerpt of the TFPL KM skills map.

Such a competency framework as developed by the TFPL could be used as a diagnostic tool for mining firms to assess recruitment needs and also to develop job descriptions and personnel specifications for knowledge roles in the sustainability department or in sustainability projects.

2.17 KNOWLEDGE MANAGEMENT TOOLS AND TECHNOLOGIES

The implementation of KM within the sustainability departments of mining firms will require a wide range of tools to come into play throughout the KM cycle. Ruggles (1997) provides a classification of tools and technologies that intervene in the knowledge processing phases:

- To enhance and enable knowledge generation, codification, and transfer.
- That generate knowledge (e.g. data mining that discover new patterns in data).
- That code knowledge to make knowledge available for others.
- That transfer knowledge in order to decrease problems associated with time and space when communicating in an organization.

According to Rollet (2003), KM technologies can be classified according to the following scheme:

- Communication
- Collaboration
- Content creation
- Content Management
- Adaptation
- E-learning
- Personal tools
- Artificial intelligence
- Networking.

Rollet's (2003) categories can be classified into the major KM phases: KM capture, KM sharing, and KM application (See Table 10).

Knowledge creation and codification phase	Knowledge sharing and dissemination phase	Knowledge acquisition an application phase
Content creation - Authoring tools - Templates - Annotations - Data mining - Expertise profiling - Blogs - Mashups Content Management - Taxonomies - Folksonomies - Metadata tagging - Classification - Archiving - Personal Km	Communication and collaboration technologies - Telephone/Internet telephone / Fax - Videoconferencing - Chartrooms/instant messaging/twitter - Email/discussion forums/wikis - Groupware - Workflow management - Folksonomies - Social Networking - Web 2.0 /KM 2.0 Networking Technologies - Intranets - Extranets - Web servers, browsers - Knowledge repository - Portal	E-Learning technologies - CBT(Computer based learning systems) - WBT (Web based Learning systems) - EPSS - Emerging technologies - Folksonomies - Metadata Artificial Intelligence Technologies - Expert Systems - DSS - Customization/personalization - Push/pull technologies - Recommender systems - Visualization - Knowledge Maps - Intelligent maps - Automated Taxonomy systems - Text analysis-summarization

Table 10: Major KM techniques, tools and technologies (Dalkir, 2011)

2.18 KNOWLEDGE MANAGEMENT STRATEGY

According to Srikantajah and Koenig (2000), a KM strategy is "a general issue based approach to defining operational strategy and objectives with specialized KM principles and approaches". A KM strategy should be able to address questions such as

1. Which KM approach or set of KM approaches will bring the most value to the organization? (Dalkir, 2011).

2. How can the organization prioritize alternatives when any one or several of alternatives are appealing and resources are limited? (Dalkir, 2011)

Once a KM strategy is established in an organization, the organization will have a roadmap that can be used to prioritize KM initiatives, tools and objectives that support the long-term business objective (Dalkir, 2011). The KM strategy is used to define a plan of action by undertaking a gap analysis that involves establishing the current and desired state of knowledge resources in a an organization (Dalkir, 2011).

According to Dalkir (2011) a good KM strategy should involve:

1. An articulated business strategy and objectives
2. A description of knowledge – based business issues
3. An inventory of available knowledge resources
4. An analysis of recommended knowledge leverage points that describes what can be done with the identified knowledge and knowledge artifacts and that list KM projects that can be undertaken with the intent to maximize return on investment and business value.

2.19 KNOWLEDGE MANAGEMENT METRICS

There are a variety of methods that can be used to evaluate how well KM is succeeding (millstone and formative evaluation) and how well KM has helped an organization attain organizational goals (outcomes and summative evaluation) (Dalkir, 2011). This includes the balanced scorecard method, result-based metric, benchmarking and house of quality matrix. Each method presents its advantages and disadvantages and often a combination of different measures may be called for.

2.19.1 The bench marking method

The benchmarking method consists of searching for industry wide best practices that lead to better performance (Camp, 1989). In other words in the benchmarking method a company would study other similar companies in order to examine the things that are done best in order to adopt them for their own use.

Tiwana (2000) adopted Spendolini's (1992) key benchmarking steps in order to arrive at a better fit with KM. The key steps to the benchmarking method are as follows (Tiwana, 2000);

1. Determine what to benchmark: which knowledge processes, products or services? why? with what scope?
2. Form a benchmarking team.
3. Select which company you will be benchmarking against.
4. Collect and analyze data.
5. Determine what changes should be made as a result of the metrics obtained.
6. Repeat when an appropriate amount of time has passed in order to measure progress.

2.19.2 The balanced scorecard method

The balanced scorecard method is a management and measurement system that allows organizations to clarify their strategy and vision and translate them to action (Kaplan and Norton, 1992, 1993, 1996). According to Dalkir (2011), the balanced scorecard method provides feedback around both the internal business process and external outcomes so as to continuously improve strategic performance and results.The balance scorecard method is a conceptual framework for translating an organizations vision into a set of performance indicators that are distributed among four dimensions: financial, customer, internal business process, and learning growth. The "balance" in the balanced score card method refers to a balance that is maintained between:

- Long term and short term objectives.
- Financial and nonfinancial measures.
- Internal and external perspectives.
- Lagging and leading indicators.

- Objective and subjective measures.
- Performance results and drivers of future results.
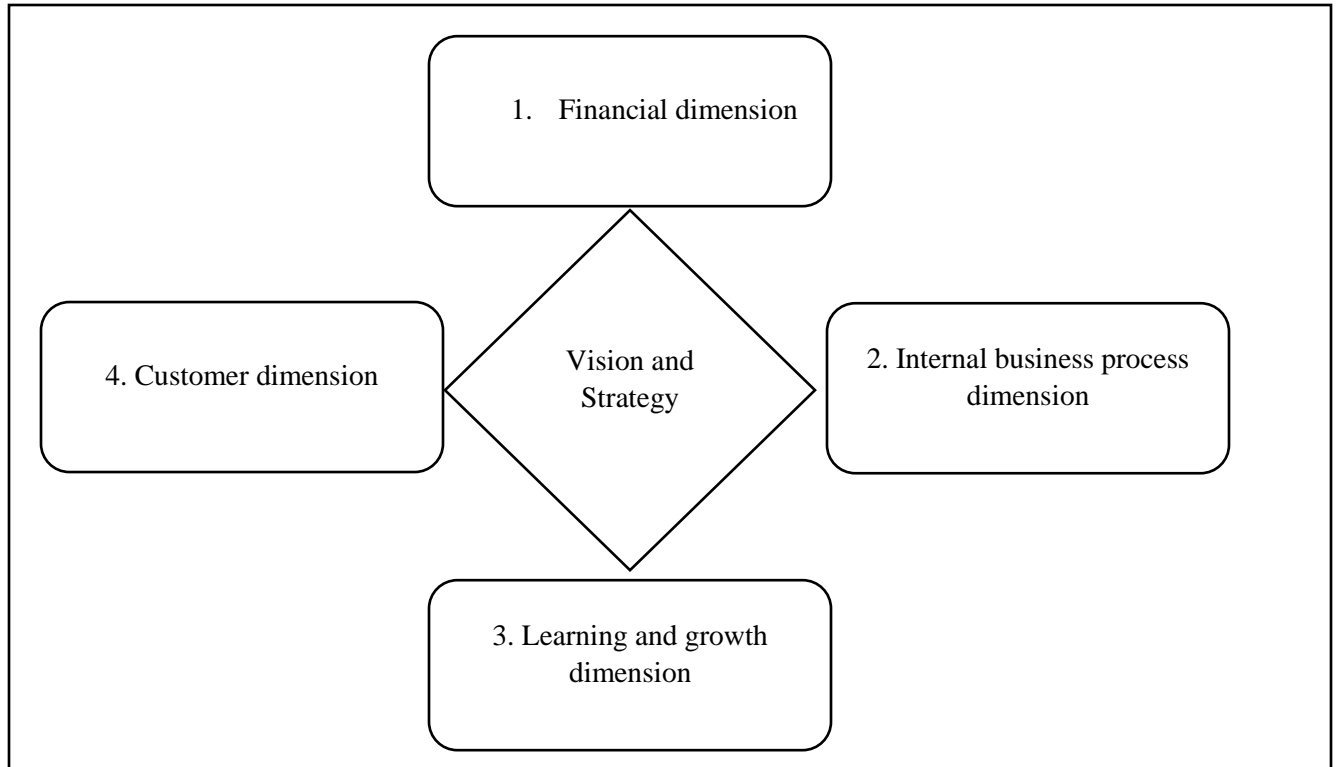
Figure 18: High-level balanced scorecard (Dalkir, 2011).

2.19.3 The house of quality method

The house of quality method is based on the quality function deployment method (QFD) which was introduced by Akao (1990) in the ship building industry in the 1970's (Camarinha-Matos et al, 2010). It has been used for several years as a quality assurance methodology (Camarinha-Matos et al, 2010). The house of quality method helps to translate customer requirement into a pertinent number of quality characteristics (Camarinha-Matos et al, 2010; Hauser and Clausing, 1988). As shown in figure 19 the house of quality method has its key elements, desired outcomes, priorities attached to those outcomes and appropriate metrics for each outcome (Dalkir,2011)
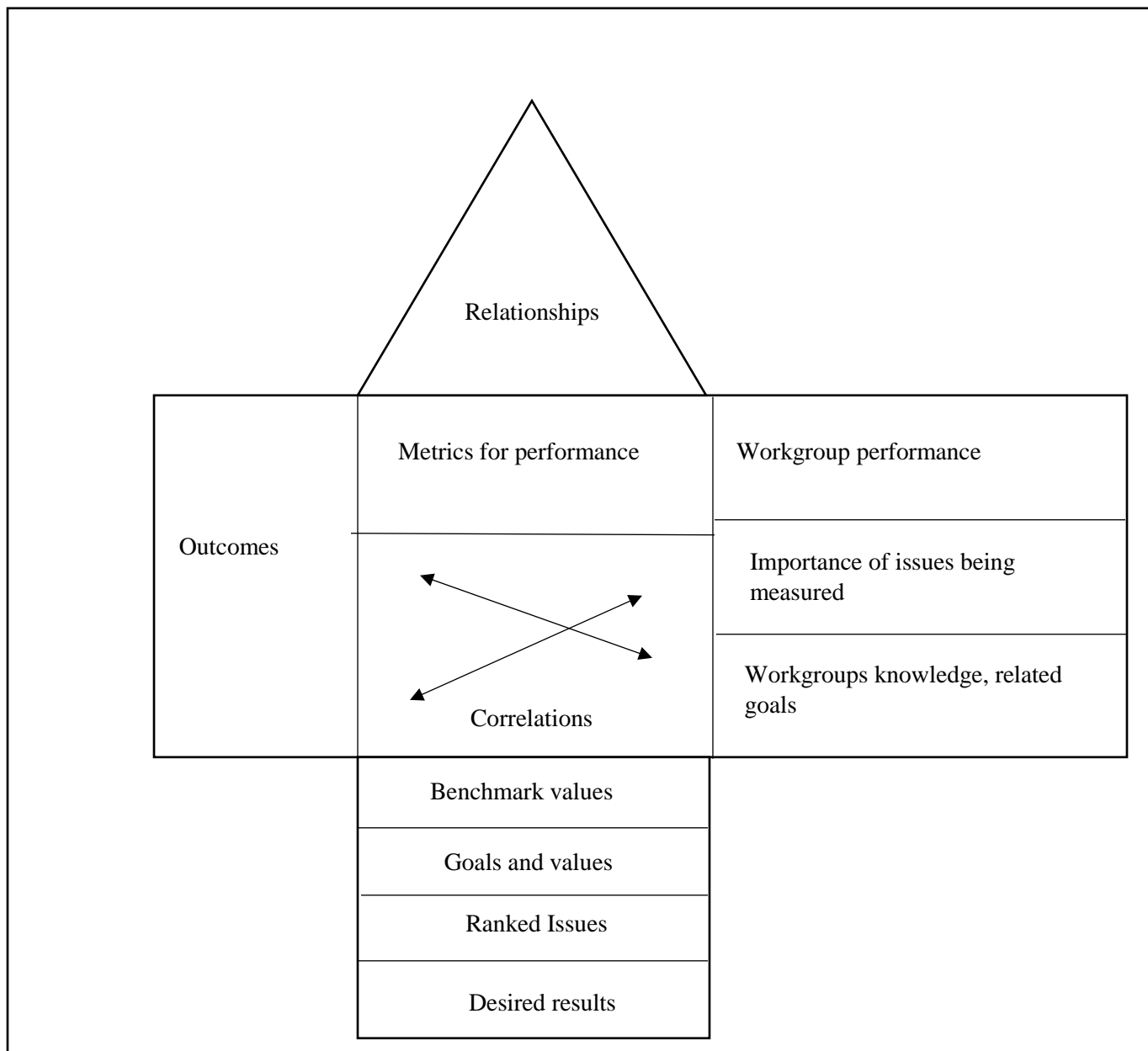
Figure 19: High-level house of quality matrix (Dalkir, 2011).

Accoring to Dalkir (2011), the focus of the house of quality method is on maximizing customer satisfaction as measured by metrics such as repeat business and market share. It focuses on delivering value by seeking both spoken and unspoken needs, translating these into design

targets and communicating it through the entire organisation. Some examples of House of quality metrics used on KM projects include;

- The information/knowledge seeking time spent on average per employee.
- The number of ideas that were implemented from the suggestion box per year.
- Time spent on systematic capture and codification of know-how for future use when a project is completed.
- The percent of employees who are aware of what KM exists within their organization (e.g. lessons learned database).

2.19.4 The result based assessment framework

The results-based management accountability framework (RMAF) is a tool that is widely starting to be used for performance assessment on various organizations such as the Canadian Federal Government and a number of United Nations (UN) agencies (Dalkir, 2011). It is fairly easy to adapt the RMAF metric to knowledge management. According to Dalkir (2011), the advantage of adopting RMAF to KM lies with the emphasis RMAF places on realistic results, monitoring of expected results, reporting, and describing measurable changes. Figure 20 shows the major components of the RMAF metric (adopted from Plan net, 2003)
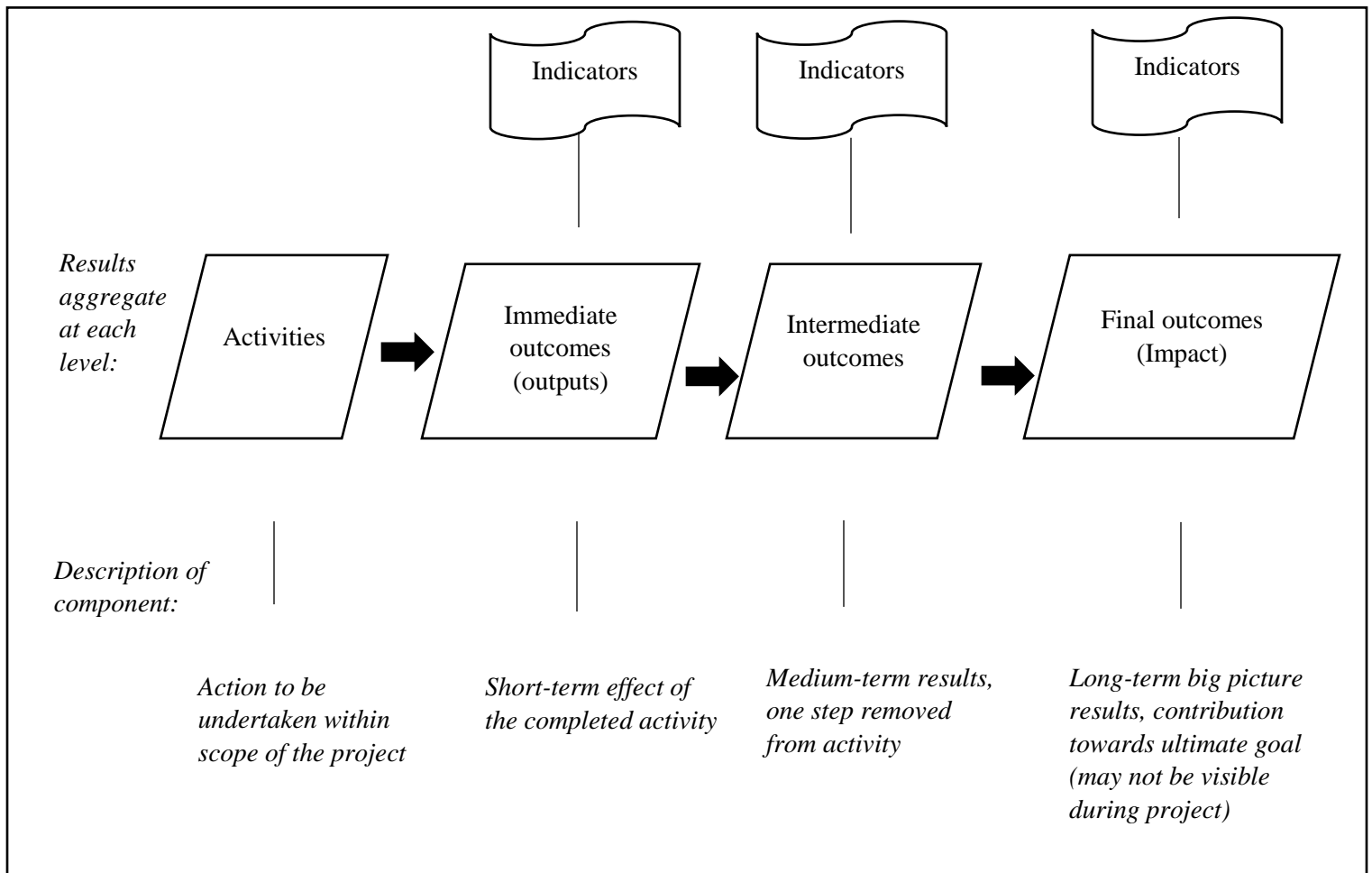
Figure 20: High –level RMAF (Dalkir, 2011).

The major attributes of the RMAF framework are: (Dalkir, 2011)

- Results Chain- explores how resources and activities connect with changes (flow type).
- Activities- actions to be undertaken within the scope of the project; outcomes (a.k.a outputs): short term effects of the completed activity.
- Intermediate outcomes- medium-term results, one step removed from activity.

- Final outcomes- (a.k.a impact)- long term big picture results, contribution toward ultimate goal (May not be visible during project).
- Indicators- evidence of progress, metrics.
- Results- aggregate at each level.

Identifying all the desired impacts, outcomes, and outputs and then connecting them with the existing and planned KM initiatives form the foundation of the RMAF metric (Dalkir, 2011). In this way, the contributions that are expected from KM toward attaining organizational goals can be easily visualized and progressively monitored using the indicators that are chosen (Dalkir, 2011).

CHAPTER 3: DESIGN OF RESEARCH METHODS

This chapter presents the design of the research method of this thesis. The chosen research approach is explained together with the procedure of data gathering and data analysis. In addition, this chapter explores the credibility of the study through concepts of reliability, validity and bias. Lastly, this chapter concludes with a brief discussion on the ethical issues that may arise at a variety of stages in business and management research. It has to be clarified that the unit of analysis in this research is an individual of a company they represent e.g. Vice -President Sustainability or Vice-President CSR of the entire sustainability initiatives of a firm. While it could be argued that they cannot represent the entire organization's position on sustainability knowledge management, their senior role and management responsibility should provide them with a more holistic view of the organization.

3.1 Identification of research method

In order to understand the potential for KM techniques and methods to better manage sustainability knowledge in the mining industry in this study, it was necessary to select the appropriate research method. Semi- structured interviews were considered the most viable option for this research. Questions could not be put into a survey because the field of KM is very theoretical in nature and some of the questions that needed to be asked are theoretically complex and require clarification, thus face to face semi- structured interview would allow for the opportunity to clarify on the theoretical questions and capture the relevant data required. Semi structured interviews were also a viable option in this study in order to allow for some open – ended questions to be asked. A qualitative research approach was undertaken in order to collect much deeper data on how KM techniques can be used to better manage sustainability knowledge in the mining industry.

3.2 Interview methods

The selection of the most suitable methodology for a thesis research is probably the key factor in determining the quality of the research in terms of both its validity and the insights it provides. (Shipton, 2001). According to Arskey and Knights, (1999) the term "interview" is used to describe a range of disparate methods of data acquisition. Kvale, (1996) goes on to mention that interviews are all forms of social interactions where knowledge evolves in the dialogue between the interview and interviewee. Bryman and Bell (2007) highlight three interview methods that are associated with data collection, they are as follows; structured interview, unstructured interview and semi- structured interview.

1) Structured Interview- entail the administration of an interview schedule also knows as a "questionnaire". All interviewees in structured interviews are given the exact same context of questioning in terms of wording and order. According to Bryman and Bell, (2007), the goal of structured interviews is to ensure that interviewees' replies can be aggregated, and this can be achieved reliably only if those replies are in response to identical cues. Questions in this method of interviewing are very specific and offer the interviewee a fixed range of answers.

2) Unstructured interviews- this type of interview method is based on spontaneous interviewer-interviewee interactions (the style of questioning is informal). Normally the interviewer would have a list of questions also called an interview guide or aide-*memoire* that would be covered in the course of the interview. The phrasing and order of questions will vary from one interview to another.

3) Semi -structured interviews -are normally organized around a set of predetermined open-ended questions with other questions emerging from the dialogue between the interviewer and interviewee (Barbara and Benjamin, 2006). They are normally done in a face-to-face format or via telephone in order to obtain data. They are the most widely used form of qualitative research and can either occur with an individual or on groups

(Barbara and Benjamin, 2006). During a semi -structured interview, not all questions are designed and phrased ahead of time (FAO, 1990). The interviewer has latitude to ask further questions in response to what are seen as significant replies (Bryman and Bell, 2007).

Given the particular aims of the research, a semi-structured interview was considered the logical choice for this study. Structured interviews were discarded as an option for this thesis due to the additional information that semi- structured interviews would provide. Several authors have employed semi-structured interview methods in their knowledge management research. In particularly, Lorne et al (2008) used semi-structured interviews to assess the relevance of knowledge management/intellectual capital (KM/IC) research, with KM/IC professionals. Table 11 shows some of the disadvantages and advantages of employing semi- structured interviews in a research study.

STRENGTHS	WEAKNESSES
Depth of information	Researcher has to avoid bias in analysis
Respondent can influence the topic, so unexpected issues/topics emerge	Analysis is time-consuming
Because the order of questions is not fixed, flow and sharing of views are more natural.	Difficult to generalize findings

Table 11: The advantages and disadvantages of employing semi structured interviews in a research study (WHO, 2014).

3.3 Design of Semi -Structured Interviews

The design of the interview questions is imperative to providing an appropriate outcome of a research. According to Caplow (1956) the principles of interviewing most generally agreed on are:

1) The interviewer should not interject his own attitude or experiences into the conversation or express value judgments.
2) The interview schedule should have the minimum number of questions in the simplest form adaptable to the problem.
3) The response, which can be anticipated from a question, is often quite different from the logical complement of the question.
4) All interview schedules and questions entail certain unpredictable efforts.
5) The attitude of the interviewer toward the respondent should always be extremely attentive and concentrated.
6) The expert interviewer is much more than a recording device. The interviewer should pursue questioning to the point where no significant ambiguities exist.

Closed ended questions in this study were developed from a comprehensive literature review and open-ended questions formulated in the interview. (A full copy of the closed – ended questions can be found in Appendix 6). The open and closed ended questions were structured to;

- Identify and discuss existing practices of sustainability knowledge acquisition, sharing and application within the mining industry.
- Identify and discuss existing practices of organizational culture, knowledge management strategies, knowledge management matrices, knowledge management technologies and the role played by senior management in promoting Knowledge management practices within their sustainability departments.

Open-ended questions were asked in order to explore for any emergent themes and ideas as opposed to relying on questions that were prepared in advance for the interview. Face-to -face mode of interactions with the participants was the chosen technique for interviewing as this method is linked to the expectation that the interviewees viewpoints are more to be expressed than they would be in a non-face-to-face interaction (Flick, 1998)

In order to check for ambiguity, completion time and overall structure, pilot interviews were conducted involving a sustainability manager industry expert. The closed ended questions to be asked were reviewed by an academic with mining industry experience, Dr. Philip Walsh and an industry expert, Dr. Nick Milton, a knowledge management expert who holds a senior knowledge manager position with BP (British Petroleum).

3.4 Determination of sample size

Unlike determining the sample size for quantitative studies using specific procedures, largely based in part on probability theory, determination of sample sizes in qualitative studies is less structured and based more upon the research approaches (Patton, 1990). As a matter of fact "there are no rules for sample size in qualitative inquiry. Sample size depends on what you (the researcher) want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources"(Patton, 1990, pg.184).

As a general rule, qualitative studies have far smaller samples sizes than quantitative studies (Cotrell and McKenzie, 2011). Quantitative studies normally collect limited amount of data from a large number of participants, whilst qualitative studies collect much deeper data from a small number of participants (Cotrell and McKenzie, 2011)

According to Norwood (2002), in qualitative studies, samples "are judged by the extent to which they are informationally representative rather than statistically representative" (Norwood, 200, pg. 234). In summary, sample sizes in qualitative studies are left to the judgment of the researcher (Cotrell and McKenzie, 2011). Sandelowski (1995) similarly accentuates on this by stating that;

"Determining an adequate sample size in qualitative research is ultimately a matter of judgment and experience in evaluating the quality of the information collected against the uses to which it will be put, the particular research method and sampling strategy employed, and the research product intended. Numbers have a place in ensuring that a sample is fully adequate to support particular qualitative enterprises. A good principle to follow is: An adequate sample size in qualitative research is one that permits-by virtue of not being too large-the deep, case-oriented analysis that is a hallmark of all qualitative inquiry and that results in-by virtue of not being too small-a new and richly textured understanding of experience"(Sandelowski, 1995, pg. 183)

3.4.1 Purposive sampling

In this study, purposive sampling was used to direct the number of samples to include in the study. According to Oliver (2006) purposive sampling is "a form of non-probability sampling in which decisions concerning the individuals to be included in the sample are taken by the researcher, based upon a variety of criteria which may include specialist knowledge of the research issue, or capacity and willingness to participate in the research"(Oliver, 2006, pg. 245). According to Oliver (2006), in purposive sampling "the researcher should make fully transparent the criteria upon which the sampling process was based" (Oliver, 2006, pg. 249). For this research, a specific group of population was kept in mind, and contacted from list of Canada's largest mining companies based in Toronto. There were 14 large mining firms that met a specific criteria who agreed to participate (a majority of which comprise the largest mining companies in Canada and the world) and one mid-size firm. The criteria upon which the 15 mining firms were selected was based upon whether the firm;

a) Had a well-established sustainability department.
b) Was likely to provide detailed data relevant to the purpose of the study.
c) Had a high impact in the industry (the total market capitalization of the 15 firms chosen is $169 billion. This comprises approximately 46% of the combined mining market cap in

Canada as there are 1668 mining issuers on the TSX/TSXV with a combined quoted market value of $370 billion) (Borden Ladner Gervais LLP, 2012). [5]

d) Is a major mining company with global operations, subject to domestic and international pressures to become sustainable in their operations.

Lastly, with the available time and resources, we were able to accomplish the interviewing of 15 mining firms.

According to Oliver (2006), one of the advantages of using purposive sampling is that the researcher can identify participants who can provide data that is detailed and relevant to the research question. One of the principal disadvantages of using purposive sampling rests on the subjectivity of the researcher's decision making. This can contribute to a source of bias and a significant threat to the validity of the research and conclusion. One way to reduce bias associated with purposive sampling is to ensure internal consistency between the aims and epistemological basis of the research and also the criteria used for selecting the purposive sample.

3.5 Interviewee selection

The first stage of the interview process involves identifying suitable individuals to be interviewed on the subject matter to be explored (Whiting, 2008). A suitable individual to be interviewed would be an individual holding a senior sustainability executive role within their organization. A suitability executive would be anyone who is responsible for the sustainability initiatives of the firm at the corporate level. This may include Sustainable Development Manager, Vice President – Sustainability or Vice President CSR. Sustainability executives were contacted by first looking up their roles and contacts within the sustainability reports published by the firm. If such information is not available in the sustainability reports, then firms were

---

[5] Please note that the combined mining market capitalization in Canada of the1668 mining issuers on the TSX/TSXV is based on data collected in 2012. The total market capitalization of the 15 firms chosen in this study is based on data from sources such as Google finance, retrieved on July, 2014.

contacted to inquire about the contacts of the senior executive that is responsible for the sustainability initiatives of their firm. In this research 16 firms were approached to be interviewed. From the 16 firms that were approached, 15 participated in the research (94 percent response rate) at which point time and resources limited further ability to approach firms.

3.6 Description of Interviews

In this study, semi-structured interviews were conducted with a fairly open framework, which allowed for focused, conversational, two-way communication. Not all questions were designed and phrased ahead of time. Some of the questions that were open-ended were in the form of clarification questions on specific questions. This allowed for both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues. The questions asked in the beginning of the semi-structured interview were general in the beginning and further became detailed as the interview progressed. In the interview, the interviewee was given a copy of a list of questions to be asked (some of which were in the form of Likert scales). The interviewer also had the same copy of questions. Both the interviewer and interviewee went through each question, with the interviewer explaining all theories and concepts to the interviewer (in order to reduce bias associated with misinterpretation). Brief notes were taken in the interview on open-ended questions. The interviews were not recorded because some of the sustainability executives were not comfortable with being recorded and in some cases there occurred an instrumental error (recordings could not be properly heard) so that the recording of interviews was not successful and was ceased.

3.7 Interview time frame

With regards to the time frame, the interviews were set to take between 45 minutes to an hour in duration.

3.8 Cover letter

To indicate the aim of the research questions and convey its significance Robson, 1993; Simmons, 2001), a cover letter was included in a package containing a list of the closed - ended questions that was sent to the firms. A statement on the purpose of the study, description of the study, risks, benefits, and information concerning sensitivity and confidentiality of the data to be collected (Coleman & Williams, 2006) was included in the cover letter. A copy of the cover letter can be found in Appendix 7.

3.9 Interview guide

Full use was made of the literature on effective research interviews. Particularly, Whiting (2008) states that during interview preparation, it is beneficial to draw a checklist that identifies practical preparations and areas that need to be clarified (Whiting, 2008). Rose (1994) highlights key issues that need to be explained to the participant, they include;

- Purpose of the interview
- A clarification of the topic that is under discussion
- Format of the interview
- Approximate length that the interview will run
- Assurance of confidentiality to the participant
- Assure participants that they may seek clarifications to questions asked
- Assurance that he or she may decline to answer a question
- Assurance to the participant that there will be an opportunity to ask questions during the interview.

3.10 Data analysis process

Much of the analysis of the data collected is presented in the form of pie charts, bar charts and tables. This is done to display results and understand processes. Some question's asked during the interviews required the participant to tick on options or scale their answer from a given frequency. This allowed for the responses to be numerically coded and graphed.   For

consistency, all bar charts are represented by the number of respondents (firms) on the X-axis and or KM processes on the Y-axis. Where additional qualitative options were provided (e.g. when participants were given the option to add further comments), these were qualitatively described in the findings using quotes.

3.11 Bias in study

Bias is a form of systematic error that can affect a study and distort the accuracy of the research findings (Sica, 2006). Sica (2006) alludes that a biased study loses validity in relation to the degree of the bias. It is difficult to eliminate all bias in a study, as its presence is universal. It should be noted that sometimes not all bias can be controlled or eliminated in a study, attempting to do so may generate new bias or a study would be rendered less generalizable (Sica, 2006). However, the awareness that biasness may exist will allow for more meaningful scrutiny of the results and conclusion.

 In this study "bias in subjects" is a likely to distort the measurement process**.** There exists some possibility that some questions may not be answered correctly due to the tendency to give "desirable answers" (Bradman and Sudman, 1979). Follow up questions can be used to compound an "inaccurate" answer. Additionally, this concern can also be alleviated by assuring confidentiality to the participant's and their firm (i.e. it will be accentuated that participant(s) and their firm(s) will not be identified in the thesis or in any report or publication based on this research and only summary results from the entire study will be presented in the final report). It is expected that by doing so, participants will be encouraged to openly speak more freely without the fear of objectively responding to questions.

 Another way to reduce subject bias is to allow the participants to critically evaluate through open dialogue how sustainability knowledge is managed in *other* mining firms. This would allow participants the freedom to express their views in their own terms on *other* firms without worrying about the image of their own firm.

In order to mitigate bias associated with unintentional human error (misinterpretation of question specifics), all concepts and theories were clarified during the interview sessions.

The use of purposive sampling may contribute to a source of bias and a significant threat to the validity of the research and conclusion. One of the principal disadvantages of using purposive sampling rests on the subjectivity of the researcher's decision making (Oliver, 2006). One way to reduce bias associated with purposive sampling is to ensure internal consistency between the aims and epistemological basis of the research and also the criteria used for selecting the purposive sample (Oliver, 2006). This was done in this study as the criteria upon which the 15 mining firms were selected was based upon whether the firm;

a) Had a well-established sustainability department.

b) Was likely to provide detailed data relevant to the purpose of the study.

c) Had a high impact in the industry (the total market capitalization of the 15 firms chosen is $169 billion. This comprises approximately 46% of the combined mining market cap in Canada as there are 1668 mining issuers on the TSX/TSXV with a combined quoted market value of $370 billion) (Borden Ladner Gervais LLP, 2012).

d) Is a major mining company with global operations, subject to domestic and international pressures to become sustainable in their operations

3.11 Ethical issues in business and management research

Interviews have an ethical dimension, whether in business or management research. Discussion of the transgression of ethical principles has revolved around certain issues such as:

1) Whether there is harm to participants– harm can entail a number of facets such as stress; harm to participant development or self-esteem; harm to career prospects or future prospects; and inducing subjects to perform reprehensible acts (Bryman, 2007; Diener and Crandall, 1978). According to the Academy of Management, (AoM) *code of ethical conduct* it is the responsibility of the researcher to assess the possibility of harm in a

research study and "take reasonable steps to avoid harming others with whom they interact and to minimize harm where it is foreseeable and unavoidable" (AoM, 2005:4).To avoid mental harm to participants in this study, subjects were treated politely and with respect for their human dignity. Additionally, report findings were presented in this thesis in a respectful way.

2) Whether there is lack of informed consent-lack of informed consent can involve "covert participation observations or simple contrived observation in which the researcher's true identity is unknown "(Bryman, 2007:137). Research participants should be given as much information as is needed by the researcher to make a decision on whether they are interested or not in participating in the study (Bryman, 2007). A consent agreement form was provided to all participants involved in this study. This agreement was designed to provide information to the participant about the research and the participant's potential involvement, including potential risks and benefits. A copy of the consent form used in this study is presented in Appendix 8.

3) Whether there is an invasion of privacy – this area of ethical concern relates to the degree to which invasion of privacy can be condoned (Bryman, 2007). The Academy of Management code *of ethical conduct* is clear in stating that the researcher has "an obligation to ensure the protection of confidential information. When gathering confidential information, AoM members should take into account the long-term uses of the information, including its potential placement in public archives or the examination of the information by others" (AoM, 2005:5). In this study, it was assured to the participants that all information they provide through participating in this study would be kept confidential. Further, it was stressed that the participant and the participants firm will not be identified in the thesis or in any report or publication based on this research and only summary results from the entire study will be presented in the final report. Participants were assured that the data collected through this study will be kept for a period of less

than 1 year in a secure location and destroyed once the data is analysed. Only the researcher and the researcher's supervisor will have access to the data collected.

4) Whether deception is involved - deception in a study occurs when researcher presents their study as something that in not really what it is (Bryman, 2007). The AoM *code of ethical conduct* states that "deception should be minimized and, when necessary, the degree and effects must be mitigated as much as possible. Researchers should carefully weigh the gains achieved against the cost in human dignity. To the extent that concealment or deception is necessary, the researcher must provide a full and accurate explanation to participants at the conclusion of the study, including counseling, if appropriate."(AoM, 2002: 1221). To avoid deception in this study, participant were provided with a copy of the results but with companies kept anonymous except for their own company.

Wax and Cassel (1981) state that the "perceived power "of the researcher in the study and "the control of research settings" can have an influence in the research. To mitigate this in the study, impartiality was reinforced and a conducive research environment was made available for the participants. To ensure anonymity and confidentiality of our research subjects, firms were coded e.g. Company A, Company B...Company O.

CHAPTER 4: RESULTS AND DISCUSSION

In order to make the results in this study more meaningful, this chapter has taken raw data extracted from interviews in order to analyze everything from existing methods of sustainability knowledge capturing, sharing and learning, application organizational culture, KM strategy, KM matrices, and KM technologies, as well as the role played by senior management in promoting KM practices within their sustainability departments. Much of the analysis of the data collected is presented in the form of pie charts, bar charts, and tables in order to display results and understand processes.

4.1 Introduction to knowledge management

Since the early 1990's interest in knowledge management have been fueled by accelerating rates of technological and market change that have resulted in innovation and learning becoming more and more important for the success of businesses (Grant, 2013). Rapid advancements in information and communication technology (ICT) have offered greater opportunities for mining companies to take advantage of the knowledge available to them (Grant, 2013). Specifically, knowledge management is starting to increasingly be accepted as part of the business agenda within mining firms in Canada. The findings of this study support this assertion. Fifteen Vice Presidents – of Sustainability and Corporate Social Responsibility (CSR) working for Canada's largest mining firms were asked whether they have heard of knowledge management as a concept of business strategy. About two-thirds (10 firms) replied with "yes." (See Figure 21). Additionally, most of these companies' senior sustainability executives offered explicit recognition of the importance of knowledge management within their corporate management system as a whole. They recognize it as a major contributor to performance enhancement.
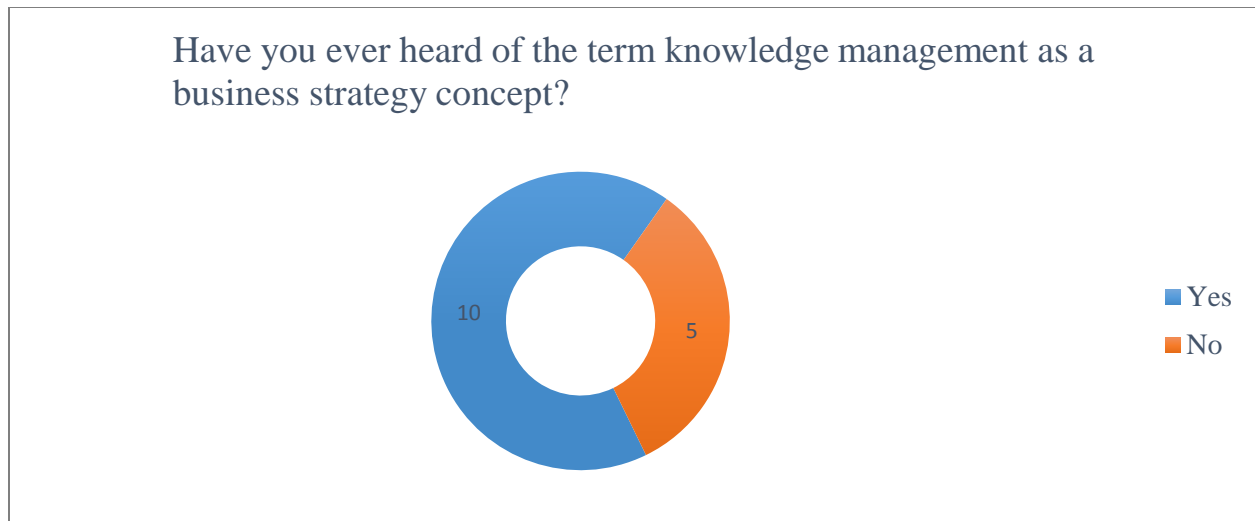
Figure 21: Awareness of KM. *Each number in the pie chart represents the number of firms.*

Grant (2013) conducted a study on the development of KM in the oil and gas industry, which reviewed the knowledge management experiences of BP, Royal Dutch Shell, Chevron, ExxonMobil, ConocoPhillips, Halliburton, Schlumberger, Paragon Engineering Services, BHP, Marathon Oil, and Murphy Oil. Senior management of the firms surveyed by Grant (2013) similarly relayed the importance of KM in improving organizational performance and in maintaining a competitive advantage. For example, Chevron's former CEO Ken Derr said,

> "We learned that we could use knowledge to drive learning and improvement in our company. We emphasize shopping for knowledge outside our organization rather than trying to invent everything ourselves. Every day that a better idea goes unused is a lost opportunity. We have to share more, and we have to share faster" (Grant, 2013, pg. 96).

BP's former chairman and CEO, John Browne, also pointed out the importance of KM in a similar fashion: "All companies face a common challenge: using knowledge more effectively than their competitors do" (Grant, 2013, pg. 96)

4.2 Knowledge capture and/or creation

        4.2.1 Tacit knowledge capture at the individual and groups level

In this study, we surveyed how mining firms capture sustainability tacit knowledge[6] at the individual and group levels. The criteria of the processes of capturing tacit sustainability knowledge at the individual and group level used in this study was, as describe earlier in this paper, based on Parsaye (1988), who outlined three major approaches to tacit knowledge acquisition from individuals and groups: interviewing experts, learning by being told and learning by observation (Parsaye, 1988).

From the findings of this study, 8 mining firms capture sustainable tacit knowledge at the individual and group level via "learning by observation." (See figure 22). Learning by observation involves watching an expert show what he knows (observing the behavior of others). Certain kinds of knowledge can sometimes be difficult to explain or explicate, but can be made clear when one watches an expert work, e.g. apprenticeships or reverse engineering. It's no surprise that close to half of the mining firms expressed that they capture sustainable tacit knowledge via learning by observation. This can be explained by the fact that observed, or vicarious, learning is one of the key cognitive capabilities of individuals (Bandura, 1986). As a matter of fact, much of our social learning as human beings is fostered by observing the actions of others, including their consequences (Bandura, 1986). The ability to learn by observation allows people to expand on their knowledge on the basis of information exhibited by others (Bandura, 1986). Bandura (1986) argues that observation has significant power in influencing others' "values, attitudes and patterns of thought and behavior" (Bandura, 1986, pg47). In the mining industry, observational learning is prevalent as there is a large field component to most of the work done. During field work, many employees tend to learn by observation which involves

---

[6] When we refer to "sustainability knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. environment (biodiversity and land stewardship, climate change, water management, etc.), economic (profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.) and social (worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

watching an expert perform a specific practical task (e.g. groundwater sampling) and then emulate that task. Certain kinds of practical field knowledge can sometimes be difficult to explain or explicate, but can be made clear when one watches an expert work. This approach involves presenting the expert with a sample problem, scenario or case study that he/she then solves.

Of the mining firms surveyed, 7 firms expressed that they capture sustainable tacit knowledge through learning by being told. Additionally 6 firms relayed that they capture tacit knowledge via "interviewing experts|". When we asked the sustainability executives to give an example of how they capture tacit knowledge via interviewing experts, 6 firms relayed that structured interviews done through exit interviews are sometimes held when a knowledgeable sustainability employee is about to leave the company or nears retirement age. It is important for the sustainability departments in mining firms to be able to use Content Management Systems (CMS) to publish lesson learned and best practices (gathered from structured interviews) that have accumulated over years of experience from staff that are soon anticipated to retire.
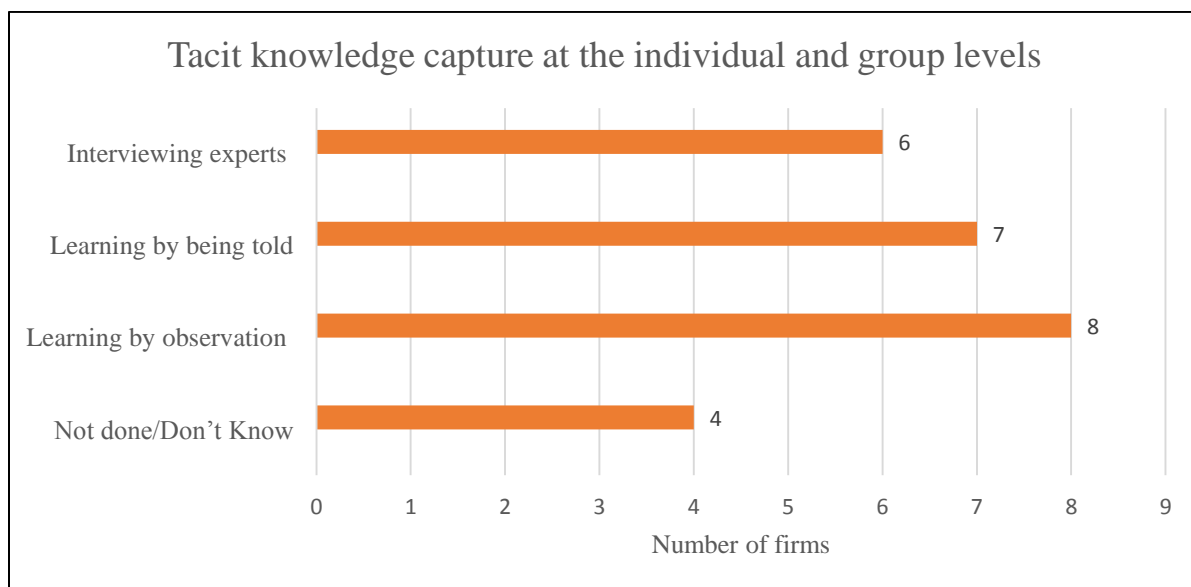
Figure 22: Tacit knowledge capture at the individual and group levels. *Please note that some firms had multiple responses.*

Some firms also expressed other methods of tacit knowledge capture. Specifically, Company E commented that,

> "Thoughts and experiences (tacit knowledge) are captured through various manners. Many employees are hired to fill a specific role based on their past experience- so they bring their thoughts into the role. Depending on the person and the role, there is also knowledge transfer through the sharing of information amongst team members, both vertically and horizontally (as in, colleague-to-colleague or manager-employee). The sustainability-related teams are however lean in terms of resources – and therefore, one gap present is a lack of documentation around day-today job duties and tasks."

Of the mining firms interviewed, 4 firms relayed that there had been no formal processes to capture sustainable tacit knowledge. This may be attributed to the fact that a lot of tacit knowledge is elusive and difficult to tap as it is socially embedded in the individual. However, tacit knowledge can to some extent be "captured" when the knowledge holder joins a network or a community of practice where one takes part in a community discussion. Up to this point, the tacit knowledge is siloed; inaccessible. Once the person is connected into a network, their tacit knowledge is linked into a connected system. It is interesting to note that the 4 firms that relayed they had no formal processes to capture sustainable tacit knowledge either do not use CoP's to share sustainability knowledge , CoP's are rare or exists only for some projects.

Although company B was amongst one of the firms that relayed this reality, the sustainability executive also highlighted that there were some ongoing discussions and genuine commitment to capture that kind of knowledge systematically. A combination of the following techniques to capture tacit knowledge, which include interviewing experts, learning by being told and learning by observation, were employed by companies K, M, and O. It is imperative to note that no one single approach (interviewing experts, learning by being told and learning by observation) should be used in total exclusion of the others, thus we assert a combination of all techniques could yield greater capturing of sustainable tacit knowledge.

All three techniques of capturing tacit knowledge at the individual and groups level as outlined by Parsaye (1988) have the potential to harness great amounts of knowledge from experts in the form of lessons learned or best practices. The lessons learned and best practices can be stored in the company's knowledge repository, and made accessible to a wider audience. By recording and storing this type of tacit knowledge, companies are able to prevent re-inventing the wheel every time, reduce on mistakes and yield greater process efficiencies. Moreover, all three techniques of capturing tacit knowledge have the potential to fill any gap that a guidebook may fail to cover.

One of the disadvantages of interviewing experts as a means of capturing tacit knowledge is the amount of time required to gather that knowledge from expert staff. In the case of intervening experts, the process of conducting semi-structured interviews in the form of open-ended questions may be time consuming, requiring a clarification of the questions being asked, as well as follow-ups of questions which may be lengthy. All this would require the patience of both the interviewee and knowledge manager. Another disadvantage of these tacit knowledge-capturing techniques (interviewing experts, learning by being told and learning by observation) is the hoarding of knowledge by employees because of the fear that others will use their ideas.

4.2.2 Tacit knowledge capture at the organizational level

At the organizational level, tacit knowledge acquisition is qualitatively different from those that occur at the individual and group levels (Dalkir, 2011). At the organizational level, knowledge capture takes place at a macro level, while we are mostly concerned about identifying and coding valuable tacit knowledge at a micro level when it comes to individuals and groups (Dalkir, 2011).

In this study, we asked the senior sustainability executives whether they captured tacit knowledge at the organizational level using the four major approaches, grafting, vicarious learning, experiential learning, and inferential processes as outlined by Malhotra (2000) and

discussed earlier in this paper. What we found was that a majority of the firms usually capture sustainability knowledge at the organizational level using all four processes (i.e. inferential processes, experimental learning, vicarious learning and grafting). (See figure 23). Most notably, 13 of the firms expressed that they "usually capture tacit knowledge through vicarious or observational learning.
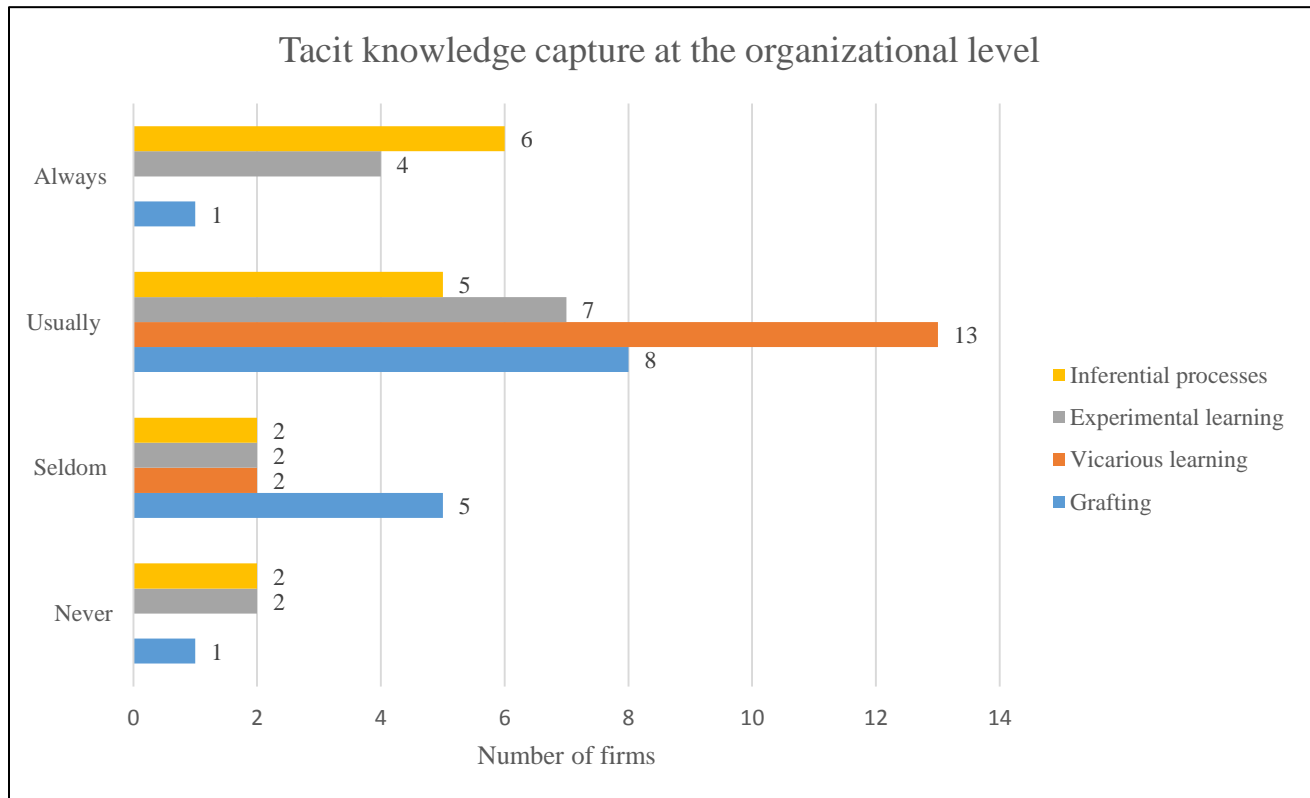
Figure 23: Tacit knowledge capture at the organizational level

This can be explained by the fact that observed, or vicarious, learning is one of the key cognitive capabilities of individuals (Bandura, 1986). As a matter of fact, much of our social learning as human beings is fostered by observing the actions of others, including their consequences (Bandura, 1986). The ability to learn by observation allows people to expand on their knowledge on the basis of information exhibited by others (Bandura, 1986). Bandura (1986) argues that observation has significant power in influencing others' "values, attitudes and patterns of thought

and behavior" (Bandura, 1986, pg. 47). Additionally, the vicarious learning process would seem to be high because it is typical in any industry, more so in the mining industry where leaning by observation occurs allot during fieldwork as certain kinds of practical field knowledge can sometimes be difficult to explain or explicate, but can be made clear when one watches an expert work. This approach involves presenting the expert with a sample problem, scenario or case study that he/she then solves.

4.2.3 Explicit knowledge codification

Once tacit knowledge is captured at the individual and group levels, or at the organizational level, it needs to be codified into an explicit form that is amenable for easy transfer and ready to be used by other staff members. Codification of tacit knowledge could be achieved through a variety of techniques, including case-based reasoning, production rules, decision table, frames, decision trees, and cognitive maps (Dalkir, 2011)[7]. We found that 2 of the firms that do codify their tacit knowledge employ case-based reasoning, production rule, and decision tables. On the other hand, the use of frames, decision trees, and cognitive maps as a means to codify tacit knowledge were used by one firm (See figure 24).

- [7]' Cased based reasoning (CBR) – is reasoning from relevant past cases in a manner similar to how humans use of past experiences to arrive at conclusions
- Production rule- Tacit knowledge codification in the form of premise- action pairs
- Decision tables are more like spread sheets, divided into a list of conditions and their respective values and a list of conclusions
- Decision Trees- Composed of nodes representing goals and links representing decisions or outcomes
- Cognitive map- visual representation of knowledge
- Frames- represents knowledge about a particular idea in a data structure' (adopted from Jayawardena, 2011)
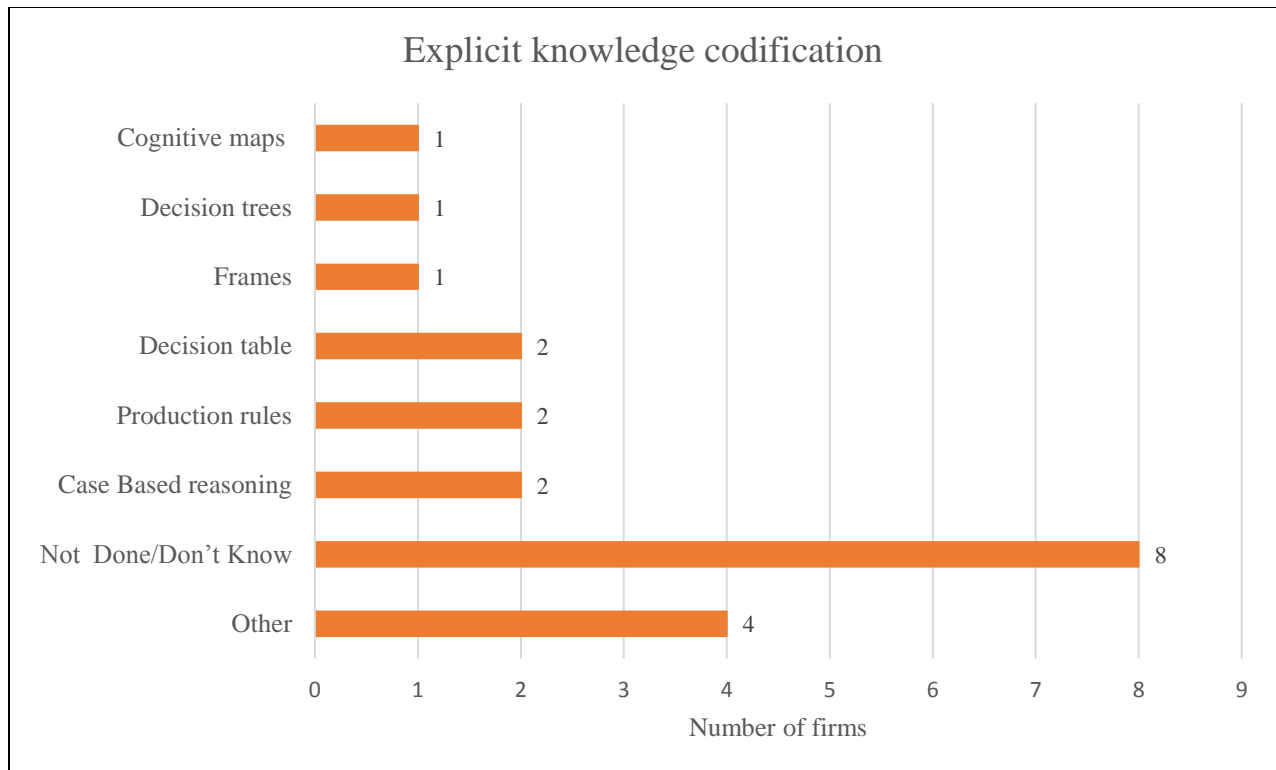
Figure 24: Explicit knowledge codification. *Please note that some firms had multiple responses.*

The most concerning finding was that 4 mining firms do not codify their tacit knowledge into an explicit form that is visible, accessible and usable for decision making. Firms that fail to codify their knowledge miss on the opportunity to convert valuable tacit sustainability knowledge into the form of a document, which can be communicated easily and with less cost for the firm. They also miss on the opportunity to build efficient, productive, and valuable knowledge bases and applications (Awad and Ghaziri, 2001). Additionally, such organizations miss on the competitive advantage of reducing the dependence on human experts who are expensive, hard to come by, and mortal (Awad and Ghaziri, 2001). Lack of resources or time could be the underlying reasons why explicit knowledge codification is not prevalent.

Company E accentuated on this by commenting that,

"Sustainability-related teams are lean in terms of resources – and therefore, one gap present internally within the firm is the lack of documented information. While this doesn't hinder the day to day completion of tasks, it introduces inefficiencies in terms of transferring knowledge to new employees. When information is documented it is typically in the form of file notes, memos, or meeting minutes."

4.2.4 Storage and access of explicit codified knowledge

The results of all the knowledge capture techniques at the individual and group level and at the organizational level will ultimately need to be stored within a company's repository or database in order to facilitate greater sharing amongst organizational members. The repository is the foundation upon which a company can create its family of knowledge products. More particularly, if a company's repository is organized, constantly renewed, has scope and depth, then this gives the company a much greater flexibility of deriving knowledge products form it.

In this study, we sought to find out how explicit codified sustainability knowledge is stored within the respective mining firms. A majority of the firms expressed that most of the explicit codified sustainability knowledge is stored on electronic copies (10 firms). Of the firms interviewed, 9 said that they stored information in hard copies and in a central electronic database (See figure 25). Most of the firms utilized a combination of techniques to store explicit codified sustainability knowledge. For example,

Company E commented that "records are predominantly electronic and are maintained on a company shared drive. In terms of knowledge sharing /guidance to the firms operations, the firm has a SharePoint site where documents can be posted".

Company F commented that in addition to storing explicit knowledge on electronic copies and on a central electronic database (company intranet), the company has a "Data Room"

Company K commented that in addition to storing explicit knowledge on hard copies, electronic copes and central electronic database (company intranet), they use "share drives and Borealis/MS"
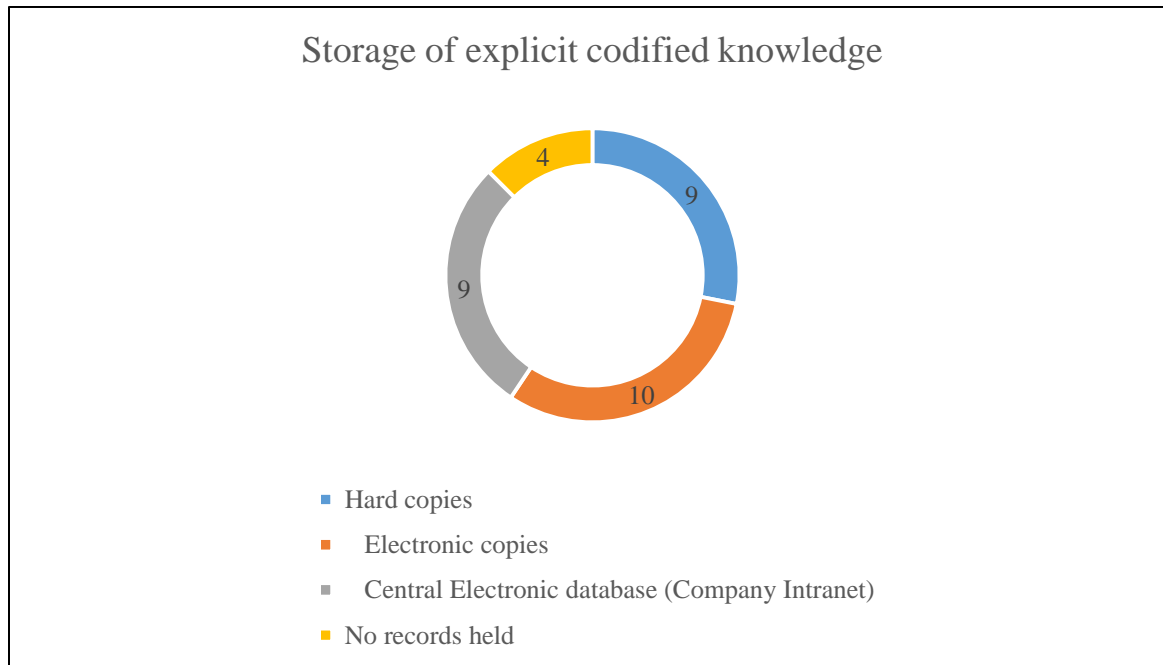
Figure 25: Storage of explicit codified knowledge. *Please note that some firms had multiple responses. Each number in the pie chart represents the number of firms.*

Company N commented that explicit knowledge is also "stored in existing common domain/drive and are accessible by members only."

Of concern is that 4 of the respondents expressed that they do not store explicit codified sustainability knowledge (no records held) at all. Firms that fail to store codified explicit sustainability knowledge lose out on building corporate memories of important information, including best practices, lesson learned, technical and managerial performance data, etc.

Additionally, if no records are held, or if there is a poorly constructed knowledge-storing infrastructure within the firm, then the ability of valuable sustainability knowledge to be shared amongst organizational members is eroded.

It is important for the 4 firms who expressed that they do not store explicit codified sustainability knowledge to learn from other firms who have previously used IT to facilitate the assembly of databases that can be used to serve as a corporate memory for important information. Grant (2013) provides a list of several extractive sector companies that have developed databases with scope and depth. For example, Schlumberger depends heavily on the use of IT to create and use directories useful to the management of knowledge. Schlumberger used a variety of tools and repositories, such as the Schlumberger Knowledge Hub (the company-wide directory and expertise finder), data dictionaries, supplier contracts, digital libraries, catalogs, general news, manuals, online training modules, and bibliographic databases. Chevron is an example of a company that has developed databases for best practices via the use of Chevron Texaco's Lessons Learned Database. BPs database of After-Action-Reviews is designed to capture positive and negative experiences. ExxonMobil is working towards a single database for safety, which will hold the records for all incidents and near-misses worldwide. They are also developing another database that collects and aggregates environmental performance indicators for corporate-wide reports.

It is important for knowledge repositories to be easily accessible and continuously renewed/refined in order to avoid information from being out of date (obsolete). Additionally knowledge repositories should be easily accessible for use by organizational members. When we asked the sustainability executives who had access to the stored explicit sustainability knowledge, 3 firms said that all employees had access, 8 firms said that employees working in the sustainability department had access, 1 firms said that specific people in the sustainability department had access, and 4 firms said that no such records were being kept. See table 12.

Staff access to the stored codified explicit knowledge	Number of firms
All employees	3
Employees working in the sustainability department	8
Specific people in the sustainability department	1
Don't Know/No records kept	4
Other	1

Table 12: Access to the stored codified explicit knowledge. *Please note that some firms had multiple responses.*

Some firms expressed limitations to the access of stored codified explicit sustainability knowledge. In particular:

Company J commented "access to information depends upon the setup when the file is saved to the electronic document management system (EDMS)".

Company E commented that "the shared drives have permission limiting access. The X site that is used for file sharing with operations also has limited access, however, hundreds of employees have been given access, mostly of whom are outside the sustainability departments".

Company N commented, "only employees working in the sustainability department have access to the codified explicit knowledge that is captures and stored AND that for confidentiality purpose, certain information cannot be accessed by contractors".

Company F commented that "although codified explicit knowledge can be accessed by all employees and employees working in the sustainability department, the "data room" is restricted to specific personnel in the organization or individuals who have signed non-disclosure agreements".

4.2.5 Project knowledge retention

Knowledge is a significant resource absolutely essential for any on-going project in an organization (Srikantaiah et al., 2010). The ability to manage knowledge in projects is imperative not only to the success of the project itself, but also to the creation of best practices and lessons learned which would ensure organizational continuity and sustainability (Srikantaiah et al., 2010). In this study, we sought to find out how project knowledge is retained and how sustainability lessons-learned are documented and transferred (See Figure 26).

From the findings in figure 26, we can see that a majority of the mining firms seldom retain project knowledge. Of the mining firms interviewed, 7 firms indicated that they usually don't have regular "project close out meetings" as soon as a project is completed to review what happened, or what the team or the firm can learn from what happened. Similarly, 7 firms indicated that they don't usually document "lessons learned "on projects as a means of passing along the things that worked or did not work on a project. Of the mining firms interviewed, 6 firms indicated that they seldom capture sustainability knowledge from one project to another and that employees didn't always learn about what made one project successful and another unsuccessful.
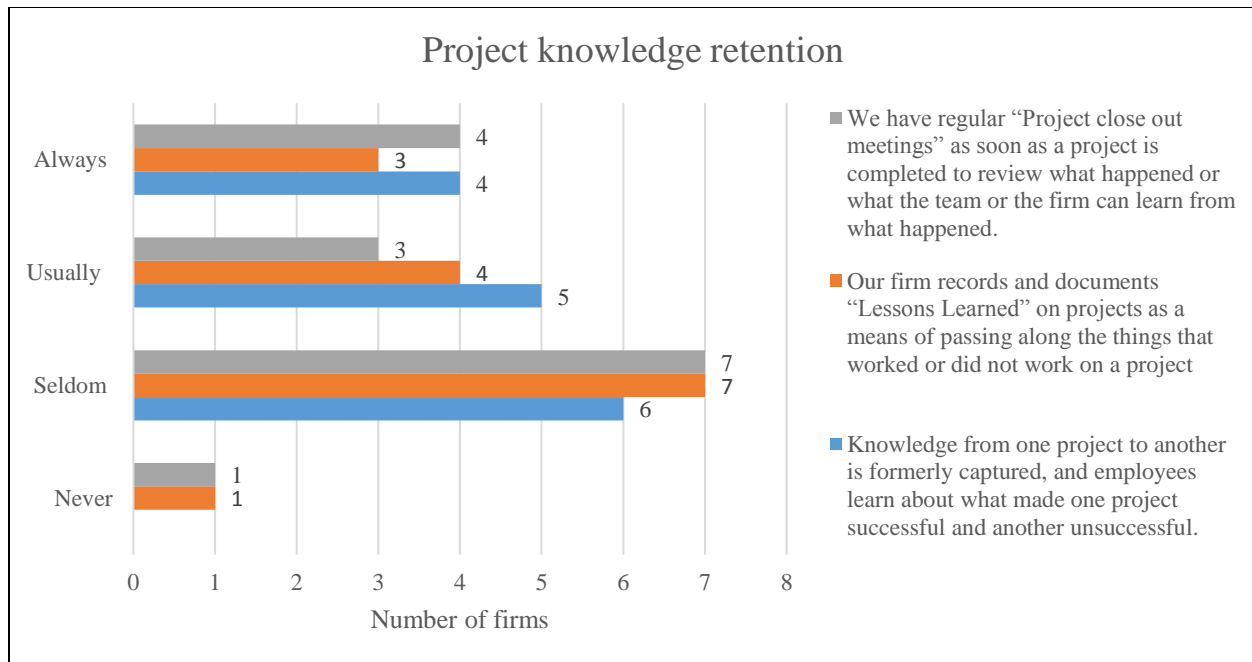
Figure 26: Project knowledge retention

Only 1 firm expressed that they never have project close out meetings nor do they usually document "lessons learned "as a means of passing along the things that worked or didn't work on a project. Specifically:

> Company L commented that "transferring of "lessons learned" from one project to the next does not occur well enough. Additionally, databases are not fully utilized to capture lessons learned from one project to the next. Learning is ignored when a project goes well and is only recognized when a project hits a problem".

> Company M commented that "knowledge from one project to another is not well captured and employees rarely learn about what made one project successful and another unsuccessful."

It is essential for knowledge to be managed effectively within projects so that mistakes are not repeated and project team members are not constantly re-inventing the wheel. Project closeout meetings are a great way of retaining lessons learned at the end of a project and storing that knowledge in a database. Knowledge management could be applied to mining sustainability projects as it has great potential to add value at all project stages (initiation, planning, execution, and closure). KM situated in the context of a project carries several benefits, one of them being that a project on its own is an effective community of practice with better familiarity and relationships amongst groups of people. Additionally, in projects (in comparison to KM in organizations) it is much easier to measure KM parameters and to correlate them with cost, quality, and productivity measures (Srikantaiah et al., 2010).

4.2.6 Managing knowledge loss

Departing employees carry with them key knowledge that is often important to a firm's capabilities, which may be a key source of best practices. Most organizations are starting to experience a high turnover rate as a result of retiring staff. Parise, et al (2006) expresses this concern by stating that in terms of broad demographics, nearly 20% of Americans holding executive and managerial positions were set to retire in 2008. In certain industries, retiring staff is nearing concerning proportions.

In this study, we found out that 7 firms interviewed relayed that they "always " and "usually" prevented the loss of sustainability knowledge from retiring operations staff and other turnover. (See figure 27).
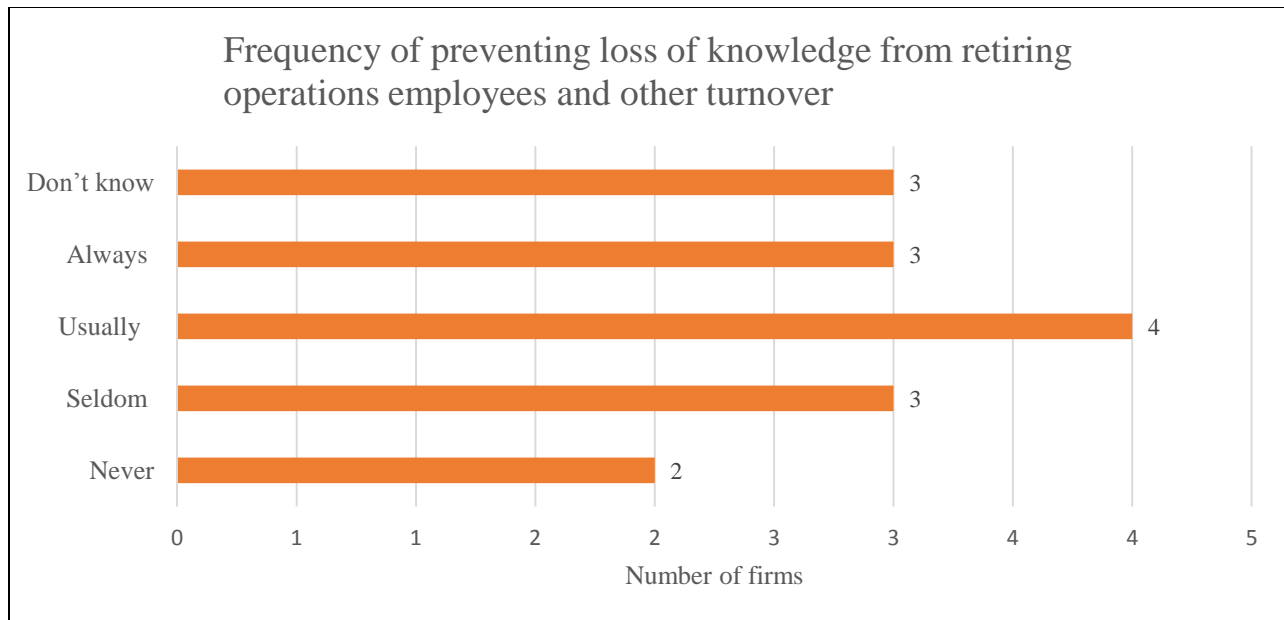
Figure 27: Frequency of preventing loss of knowledge from retiring operations employees and other turnover

Of the mining companies surveyed, 5 firms relayed that they "never "and "seldom" prevented the loss of sustainability knowledge from retiring operations staff and other turnover. A concerning 2 firms expressed that don't prevent the loss of knowledge due to human resource attrition. This is concerning as in the mining industry, baby boomers are starting to retire. Years of cumulative knowledge and experience will be lost to the mining industry as a result of technical staff retiring. The inability to prevent   knowledge loss as a result of human resource attrition is a major issue of concern for the mining industry. As a result, a number of inter-organizational and industry wide knowledge sharing networks have been established (e.g. the Global Benchmarking Group which is a made up of representatives from the world's largest oil companies, APQC KM conferences and the Energy Knowledge Management Network) (Grant, 2013)

In the context of preventing the loss of sustainability knowledge due to human resource attrition we asked mining firms whether they employed any techniques to preempt the risk of losing vital sustainability knowledge from departing employees. Of the mining firms surveyed, 6 firms

indicated that structured exit interviewing was used. From the mining firms we surveyed, 5 firms indicated that the prevention of the loss of knowledge due to staff turnover was not done. (See table 13).

Techniques of pre-empting the risk of losing vital sustainability knowledge from departing employees.	Number of firms
Structured interviews	6
Knowledge transfer techniques	3
Other	1
Don't Know/Not done	5

Table 13: Techniques of pre-empting the risk of losing vital sustainability knowledge from departing employees

Structured interviews are typically based on capturing, codifying, and storing the knowledge of the departing staff member (including lessons learned and best practices in projects where he or she was a key member). According to Parise et al (2006), structured interviews are helpful, but often lead to two serious problems;

1) First, just because knowledge has been captured from departing staff, codified and stored into a database, does not mean that the knowledge will ever be found and interpreted into the right way, or even given enough credibility to be used. In addition, knowledge retention processes like structured interviews only capture a small fracture of what made an individual successful or knowledgeable to begin with. Staff who leave a company may take many kinds of knowledge with them, including subject matter expertise and organizational memory of why vital decisions were made (the results which may never have been documented)

2) Second, knowledge retention processes such as structured interviews sometimes focus on a person's knowledge independent of the networks or relationships that were important in getting the work done. As work in a firm gets more complex, staff members rarely accomplish anything of substance by themselves and rely on other workers or external

parties for help. Few knowledge retention techniques take into account this network-based approach. When employees leave, they not only depart with what they know, but with who they know. A study by Cross and Parker (2004) demonstrated that such relationships are very important sources of information and performance in an organization. An employee who has over 10 years of work experience in a particular firm cannot be replaced with another employee with the same skills without incurring disruptions in the web of formal and informal relationships that get the actual work done.

As highlighted by Parise et al (2006), knowledge retention processes such as structured interviews sometimes focus on a person's knowledge independent of the networks or relationships that were important in getting the work done. When sustainability employees leave a mining firm, they are likely to cause a disruption in the network or relationships that is important in getting the work done. Hence, Parise et al (2006) use an approach called Organizational Network Analysis (ONA) in order to uncover important employee relationships and avoid critical disruption. In particular, Parise et al (2006) performed ONAs at 80 organizations of varying sizes and industries, and found that the usage of such analyses helps to;

"(1) Identify key knowledge vulnerabilities by virtue of both what a person knows and how that individual's departure will affect a network and

(2) Address specific knowledge-loss issues based on the different roles that employees play in the   network." (Parise et al 2006, pg. 33)

According to Parise et al. (2006) ONA can highlight the unique knowledge that is held by three types of employees: central connectors, brokers, and peripheral players (See figure 28).
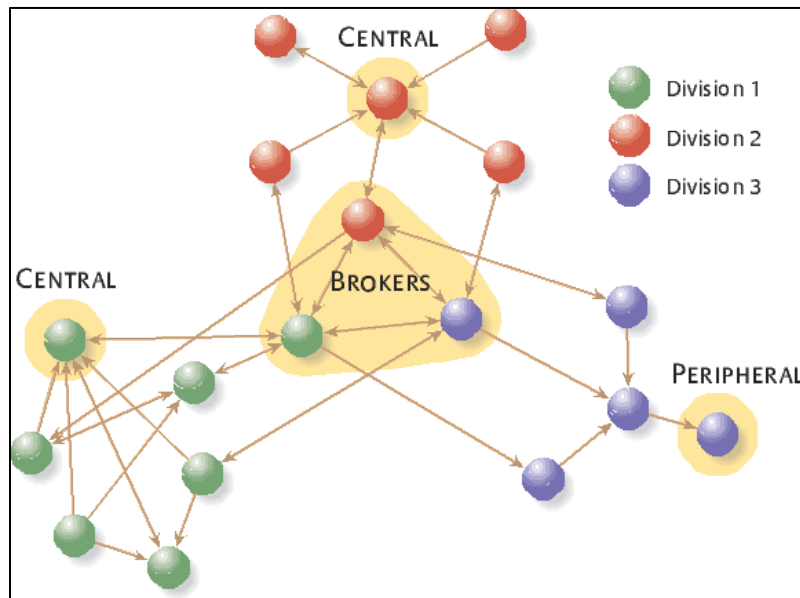
Figure 28: Three Key Network Roles: Central Connector, Broker and Peripheral Player (Parise et al. 2006)

Central connectors are people who have a high number of direct relationships because of the high level of expertise they've accumulated in one particular area. People usually seek information from them .The knowledge that they possess is called "deep smart," as it is expertise that is based on experience, intuitive judgment, and the ability to analyze problems from varying perspectives .An example in the mining industry would be geologists who have accrued decades of experience. This geologist would be valued for their ability to prospect for minerals, oil or gas. Figure 29 shows how the overall connectivity of a network can drop dramatically when 10% of the people with the greatest number of links (central connectors – as represented with the grey circles) leave.
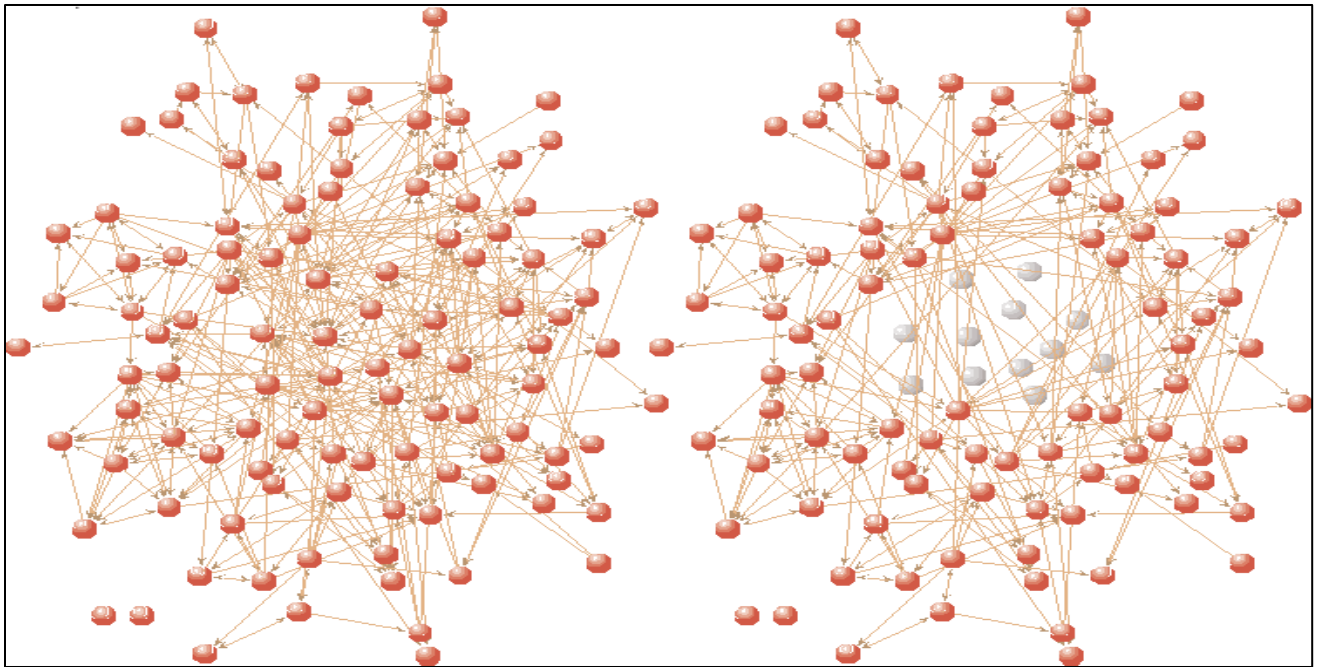
Figure 29: The importance of central connectors. Various connections between different employees (left). When 10% of the people with the greatest number of links (central connectors – as represented with the grey circles) leave (right) (Parise et al .2006).

Brokers are people who have connections to subgroups and serve to integrate the entire network. Some employees can serve as both brokers and as central connectors. Compared to central connectors, brokers may not have the greatest number of connections, but they do have a disproportionate ability to "help an organization capitalize on opportunities requiring the integration of disparate expertise" (Parise et al 2006, pg. 35). When staff members that serve as brokers depart, they might not affect as many people as when a central connector leave, but their absence can fragment a network at key junctions. (See figure 30).
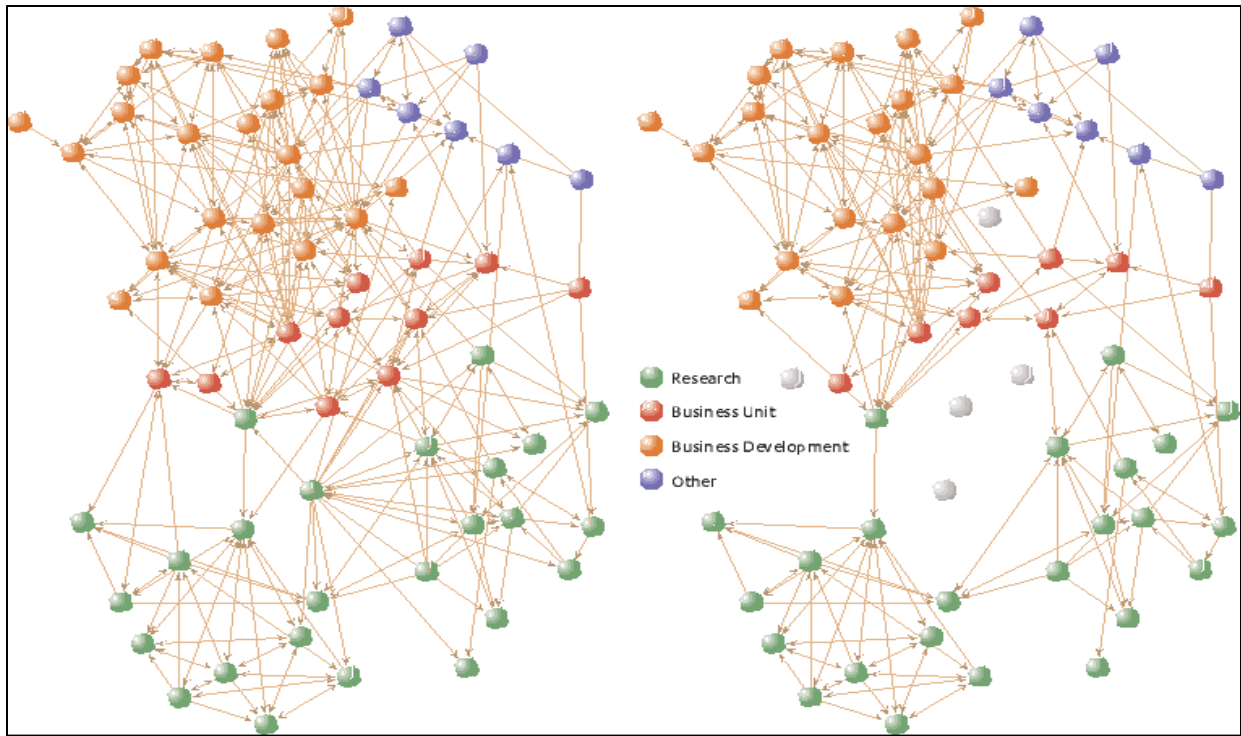
Figure 30: The importance of brokers. The information network of a services organization (left), with the green, red, orange and purple circles representing the research, business units, business development and other groups, respectively. If just the top five brokers are removed (as represented by the gray circles, right), the network becomes much more fragmented (Parise et al .2006).

Peripheral players have the fewest number of connections and reside outside of the network. They tend to be more disengaged with an organization as compared to brokers or central connectors. Consequently, they are more likely to leave an organization because of their disengagement (and sometimes dissatisfaction) compared to brokers and central connectors. Because they are on the periphery, some organizations tend to overlook them when it comes to knowledge retention plans. However, this is a big mistake, as peripheral players may be well connected with external networks. Therefore, they present the risk of two kind of information loss: niche expertise and outside knowledge.

Table 14 shows the three key network roles, the knowledge-loss risk associated with each of those three roles, and the corresponding actions taken to prevent the knowledge loss [Table 14 is adapted from Parise et al (2006)].

Network Role	Knowledge –Loss Risks	Actions
Central Connector	• Technical expertise and organizational memory as well as a set of relationships that help many others get information or other resources to do their work. •Experiential knowledge and reputation that enable rapid onboarding of new employees.	• Use personal network profiles in career development and onboarding practices to create network redundancies systematically where departures might dramatically fragment a network. • Reallocate information access and decision rights to ensure that one point does not become too vulnerable in the network. • Have central connectors lead communities of practice as a means of creating connections around them. • Require central connectors to help newcomers get acclimated through strategic introductions, "shadowing," mentoring and joint projects.
Broker	•Broad knowledge of how the organization operates and	• Identify and develop brokers through staffing and rotation

	ability to recognize opportunities that require integration of disparate expertise. • Ability to mobilize and coordinate efforts of disparate groups to pursue those opportunities.	across division, geographic and expertise groups. • Assign brokers strategically where information gaps exist or where ideas can move from concept to action. • Give brokers preauthorized decision limits to tap into network resources. Allow them to experiment to obtain real-time information.
Peripheral Player	•Niche (and often marginalized) expertise or early-adopter ideas that have the potential to reshape offerings or operations. •Set of external relationships built on trust and familiarity.	•Ensure relevant peripheral people are visible and engaged, for example, by encouraging their hosting of "lunch-and learns" and webcasts. •Invite external partners to conduct workshops and attend meetings to broaden the network. •Reward employees for bringing external ideas and connections into the organization.

Table 14: Knowledge – retention strategies by network roles (Parise et al .2006).

4.3 Knowledge sharing and learning

4.3.1 Sharing of sustainability knowledge through Communities of Practice (CoP)

In the mining industry, CoP is the most widely and enthusiastically used KM tool (Grant, 2013). This study affirms this as 9 firms interviewed indicated that CoP exist throughout the sustainability department and are maintained, monitored, and used to add value to the department by sharing lessons learned (see figure 31). It was very interesting to note that CoP's in a firm (company E) first started in the exploration department where the company established communication and consultation networks between technical staff in order to share expertise and know –how. The success of CoP in the exploration department had resulted in it being extended throughout to other company functions such as environment, health and safety.
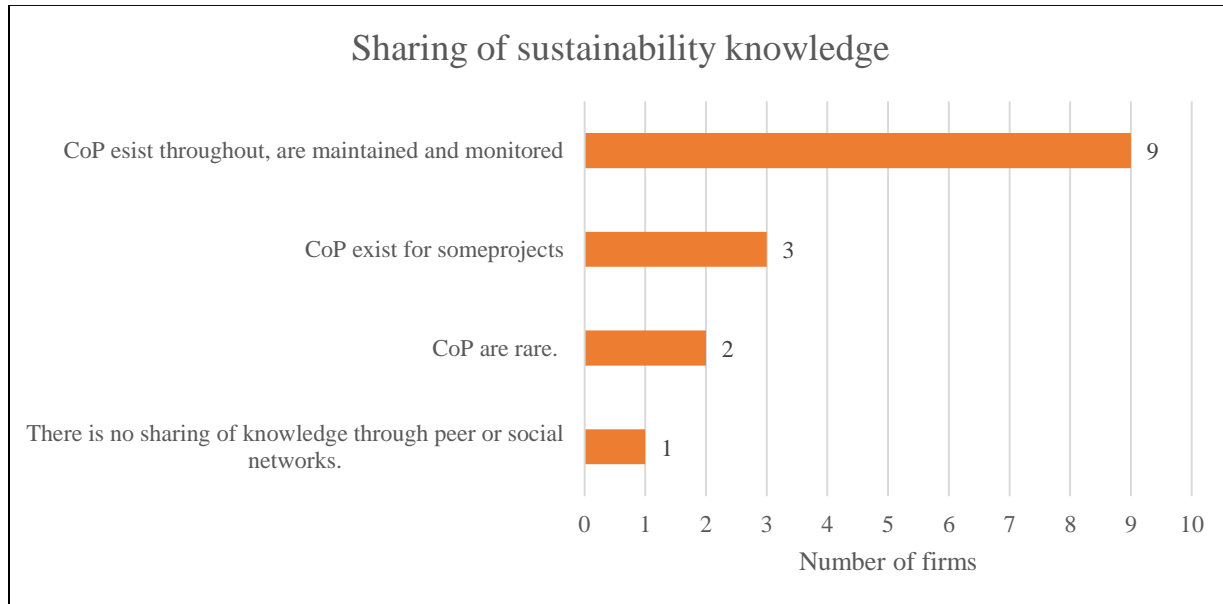
Figure 31: Sharing of sustainability knowledge.

Although not explored in this research, it would have been interesting to see what differentiates the CoP's in each sustainability department in each firm (i.e. are they differentiated by the degree of formalization, the support they receive from management or the process through which they were formed).

105

In some of the largest oil and gas firms the main difference in the use of CoP relate to the process through which they were formed e.g. Halliburton had a KM director with a staff of four assistants responsible of developing communities and staying involved with them after deployment through quarterly meetings (Grant, 2013). Each CoP at Halliburton had at least one full time knowledge broker who was responsible for monitoring and moderating a community portal (Grant, 2013). In total, Halliburton had roughly 350 CoP members to each knowledge broker (Grant, 2013). The knowledge brokers also keep in touch with each other (Grant, 2013). At Shell, CoP began as spontaneous associations in the firm but however started to become formalized over time (Grant, 2013). The starting point in the formulation of a CoP at Shell was typically around 15 founder members, one of who agreed to act as a coordinator, together with a facilitator who was experienced in initiating new networks (Grant, 2013). In 2000, this lead to the 107 CoPs in the exploration department (Grant, 2013). To achieve greater coherence and effectiveness, mergers between communities were encouraged (Grant, 2013). By 2003, Shell had 14 Global Networks covering the following areas: benchmarking, competitive intelligence, commercial, eBusiness, human resources, health, safety, and environment, IT, knowledge sharing, opportunity evaluation consistency, procurement, subsurface, surface, special interest areas, wells (Grant, 2013)

The use of a CoP can be a valuable asset for sharing best practices and lessons learned concerning sustainability information within the mining industry. Kernor and Mac (2010) state the positive outcomes of the use of CoP:

> "CoPs offer organizations the opportunity to leverage talent and strengthen team building through their unique composition of individuals with collective knowledge, specialized skills, and passion for the work. As team building represents the cultivation of unity and a joint sense of belonging, CoPs reflect a distinct mechanism to optimize success within organizations'

Some studies, however, have provided criticism for the use of CoP (Contu and Willmott, 2003; Fox, 2000; Handley et al., 2006; Marshall and Rollinson, 2004; Mutch, 2003). Wenger et al. (2002) in his book *Cultivating Communities of Practice* argues that;

"The very qualities that make a community an ideal structure for learning – a shared perspectives on a domain, trust, a communal identity, long-standing relationships, an established practice – are the same qualities that can hold it hostage to its history and its achievements' (Wenger et al. 2002, p. 141)

4.3.2   Visually mapping the relations between employees to identify knowledge flows

Visually mapping the relationship between people is an important process for the identification of knowledge flows (i.e. who people seek knowledge information from or who they share their information and knowledge with). In this study, we found that visually mapping of the relations between employees within their respective sustainability departments within the mining firm is primarily done through organizational charts (6 firms expressed this). Of the mining firms surveyed 9 firms said that the visual mapping of employee relations to identify knowledge flow is not done (See table 14). Company O specifically commented that,

"The firm has begun the process of mapping relations on information flows, but the process is new. Therefore the firm relies on individuals' experience and memory."

Similarly, company E commented that,

"Usually mapping of the relations between people in order to identify knowledge flows occurs more typically through general conversation and interaction through the firm's offices. While organizational charts are sometimes used, they are only a tool. Conversation/discussion amongst employees is the more common route for mapping the relationships for knowledge flows.'"

Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?	Percentage of respondents (Firms)
Yes we do through social network analysis charts	0
Yes we do through organizational charts	6
Don't Know/Not done	9

Table 14: Visually mapping the relations between employees to identify knowledge flows

According to Dalkir (2011), the use of organizational charts has limitations in the sense that they show only formal relationships (i.e. who works where and who reports to whom) (Dalkir, 2011). Social Network Analysis (SNA) on the other hand shows informal relationships, i.e. who knows whom and who shares information with whom (Dalkir, 2011). SNA, therefore, allow managers to better visualize and understand the many relationships between staff that can either impede or facilitate knowledge sharing (Anklam, 2003). This can help hasten the flow of information and knowledge across the organization.

4.3.3 Technologies and techniques to share sustainability knowledge

In this study, we asked the sustainability executives to gauge the frequency of certain techniques and technologies to share sustainability knowledge. (See figure 32). The results prove that there is more of a combination of KM techniques employed to share sustainability knowledge than KM technologies. There is more of a focus on tacit knowledge sharing techniques than there are for explicit knowledge sharing. For the core activity, mentoring and coaching (10 firms use this) is the most frequent technique used to share sustainability knowledge. Coaching and mentoring are emerging as critical activities to achieve knowledge transfer. A study published by the International Personnel Management Association compared outcomes from training compared

with outcomes obtained when training was combined with coaching (Laabs, 2000). The productivity gains for training alone were 22%, but when coaching was used as well, the gains were 88%; the gains of training increased fourfold when it was combined with coaching. In the context of the mining industry, these results suggests that coaching and mentoring are increasingly being seen as essential aspects of an effective organizational learning strategy.
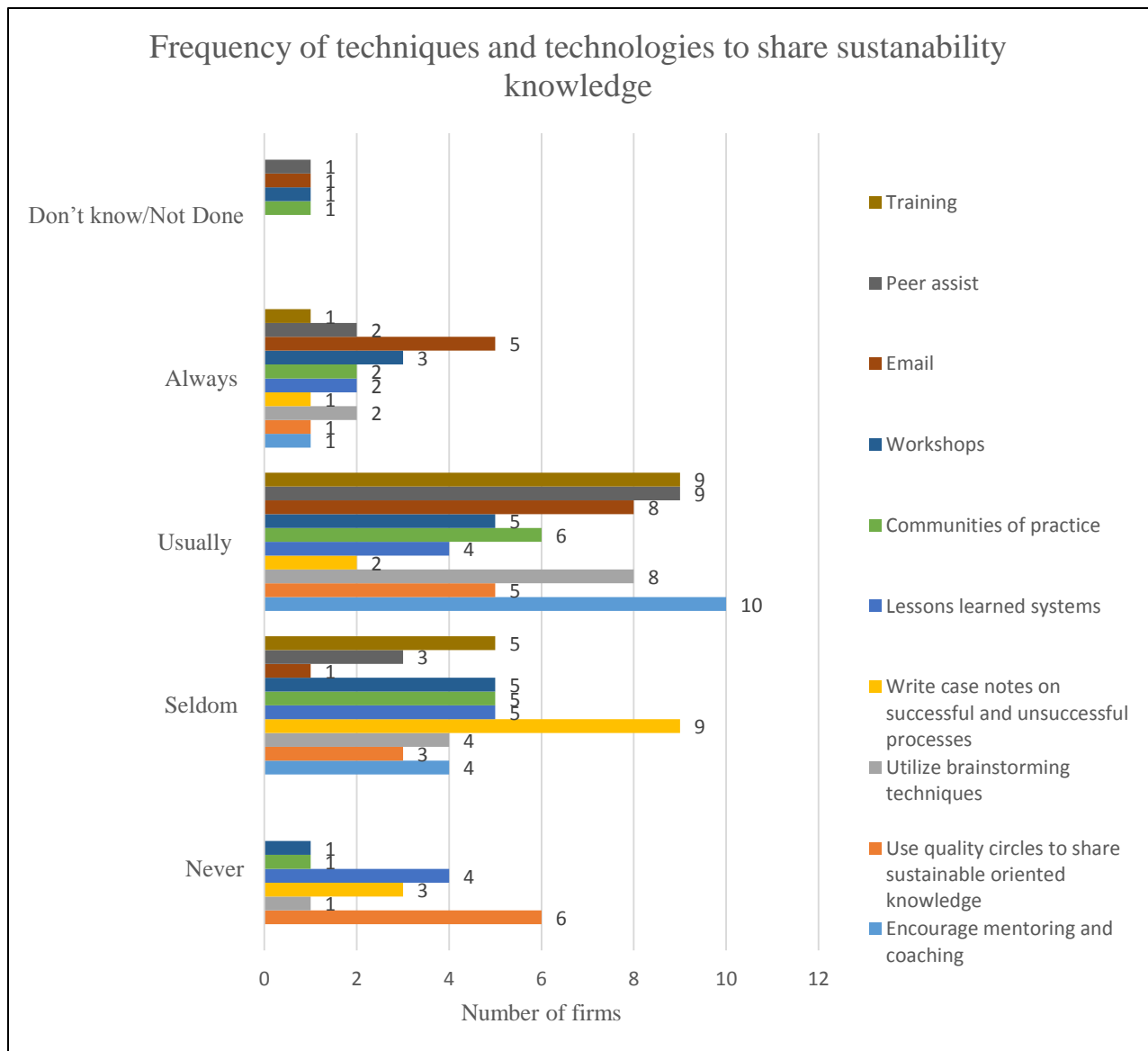
Figure 32: Frequency of techniques and technologies to share sustainability knowledge

4.3.4 Sharing and maintaining best practices

In this study 11 firms indicated that good ideas, through knowledge sharing, leads to best practices.[8] (See figure 33).
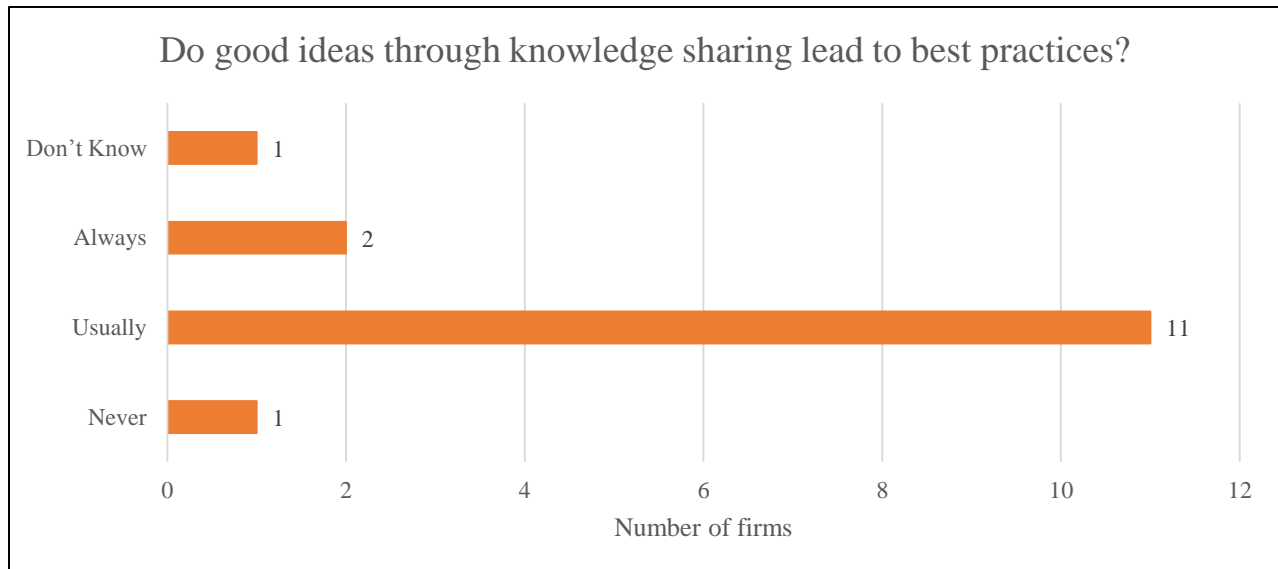
Figure 33: Generation of best practices

Additionally 5 firms indicated that best practices are stored, constantly maintained and updated. However, 9 of the firms indicated "best practices is made available to a small portion of staff and not routinely updated." (See Figure 34). These 9 firms treated best practices as a static concept. In knowledge management, best practices is a contentious term. Best practices ought to be viewed as temporary and contextual (i.e. there may be a current "best way" to do something), but like "world champion" or "world record," it's not going to stay the best for long (Milton, 2010). If an organization clings to a best practice, thinking it's *the* best, then they may be oblivious to the fact that such a "best practice" will soon be superseded. Many organizations use the term "best practice" as an excuse not to learn. A best practice should be viewed as a starting point,

---

[8] According to the Oxford dictionary, a best practice is defined as a "commercial or professional procedures that are accepted or prescribed as being correct or most effective" (Oxford Dictionaries, 2014).

with room for improvement. Best practices need to be dynamic and constantly updated to be able to innovate and improve beyond it.
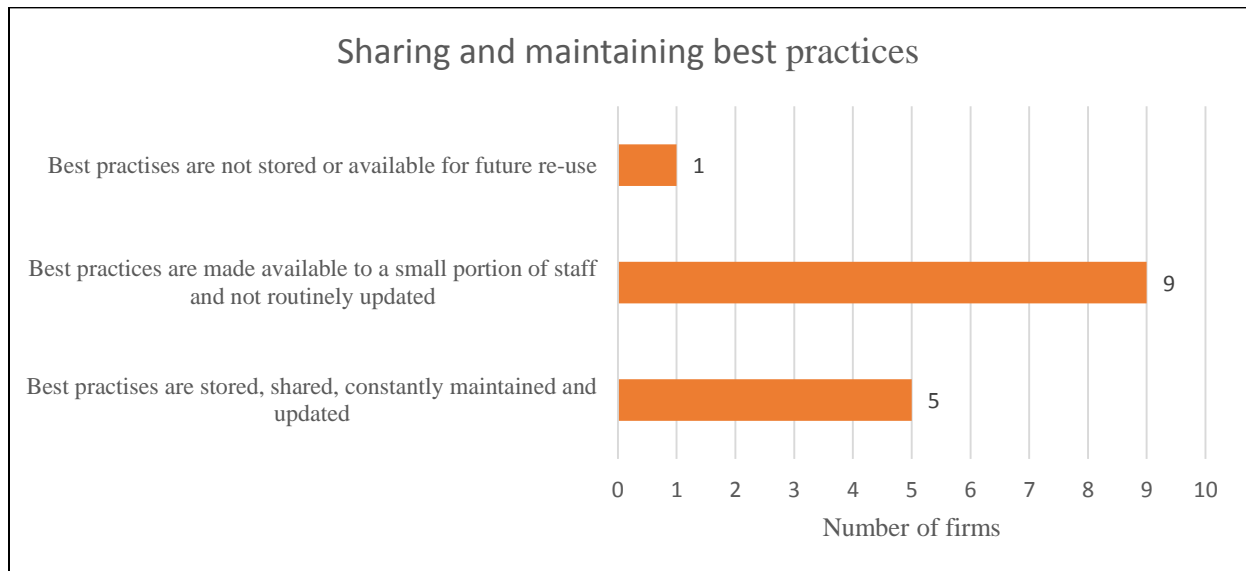
Figure 34: Sharing and maintaining best practices

4.3.5 The flow of Knowledge within projects -learning before, during and after

In this study, we explored the frequency of learning at the start, during and the end of a project (See figure 35, 36, 37). The findings show that learning within sustainability projects occurs to a lesser extent in the beginning (50%-7 firms), but rises a bit during (57% -8 firms), and after a project (64 % - 9 firms). From these findings, we can clearly see that there is a need to manage knowledge and learning properly before the start of a project in order to access the knowledge that is needed. Learning before a project or activity can involve identifying the knowledge which will be useful to the project team on helping them deliver the project objectives, identifying the sources of that knowledge (both tacit and explicit), and doing something to bring the knowledge to the team"(Milton, 2005)

111

a) Frequency of learning at the start of a new project

Category	Number of firms
Never occurs	1
Is rare	1
Happens some of the time	7
Happens all the time	5

b) Frequency of learning during a project

Category	Number of firms
Never occurs	1
Is rare	0
Happens some of the time	8
Happens all the time	5

c) Frequency of capturing and documenting new knowledge to share with others at the end of a project

Category	Number of firms
Never occurs	2
Is rare	0
Happens some of the time	9
Happens all the time	3
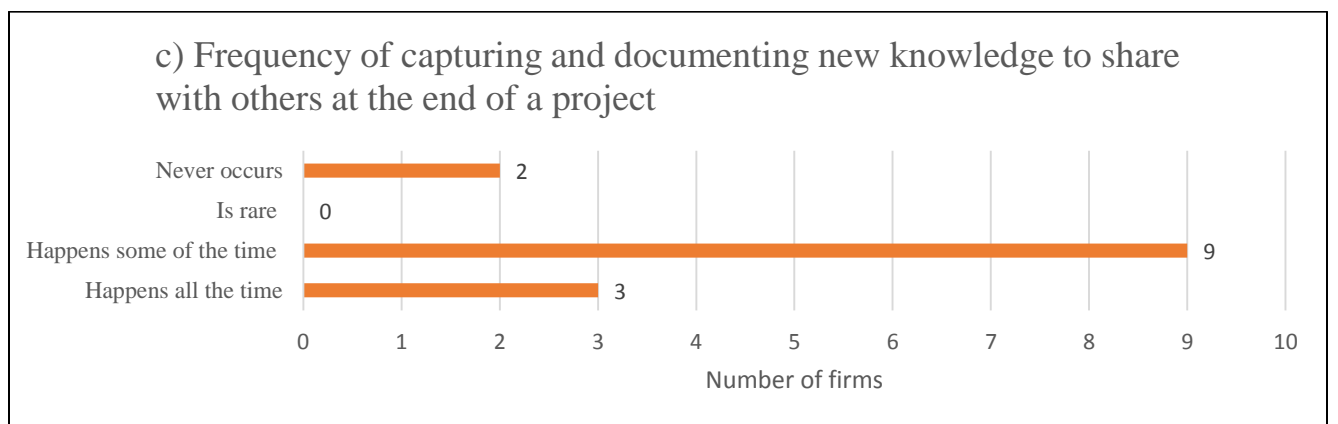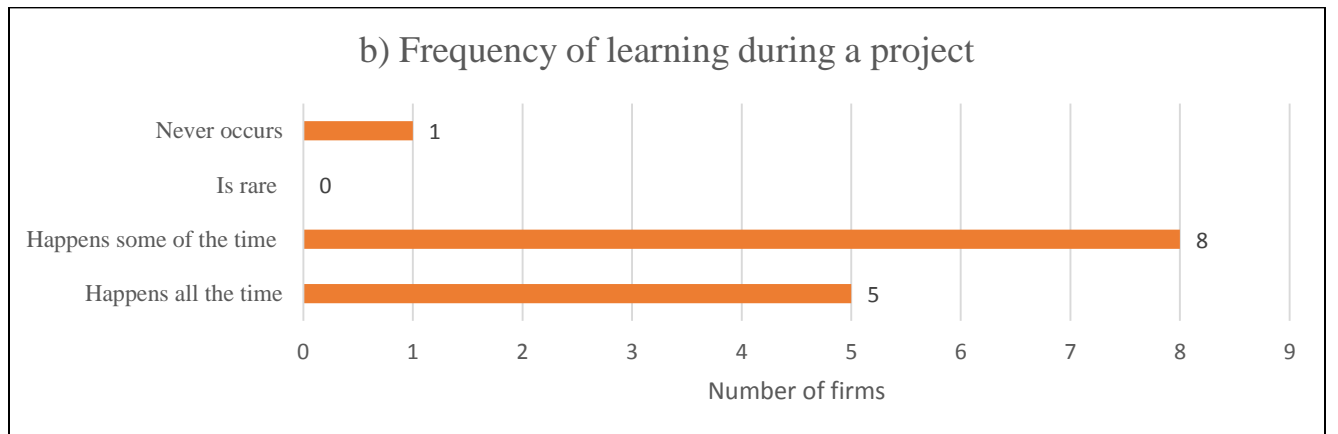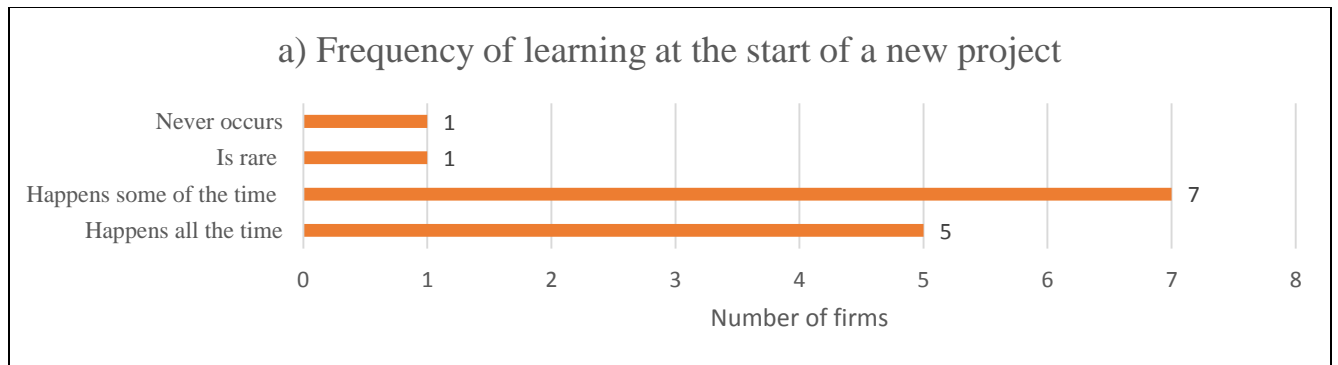
(a)Figure 35: Frequency of learning at the start of a new project; (b) Figure 36: Frequency of learning during a project; (c) Figure 37: Frequency of capturing and documenting new knowledge to share with others at the end of a project

Milton (2005) offers various learning activities that could be used before each of the key project stages. (See figure 38), All of these learning activities can be applied to sustainability projects in the mining industry.
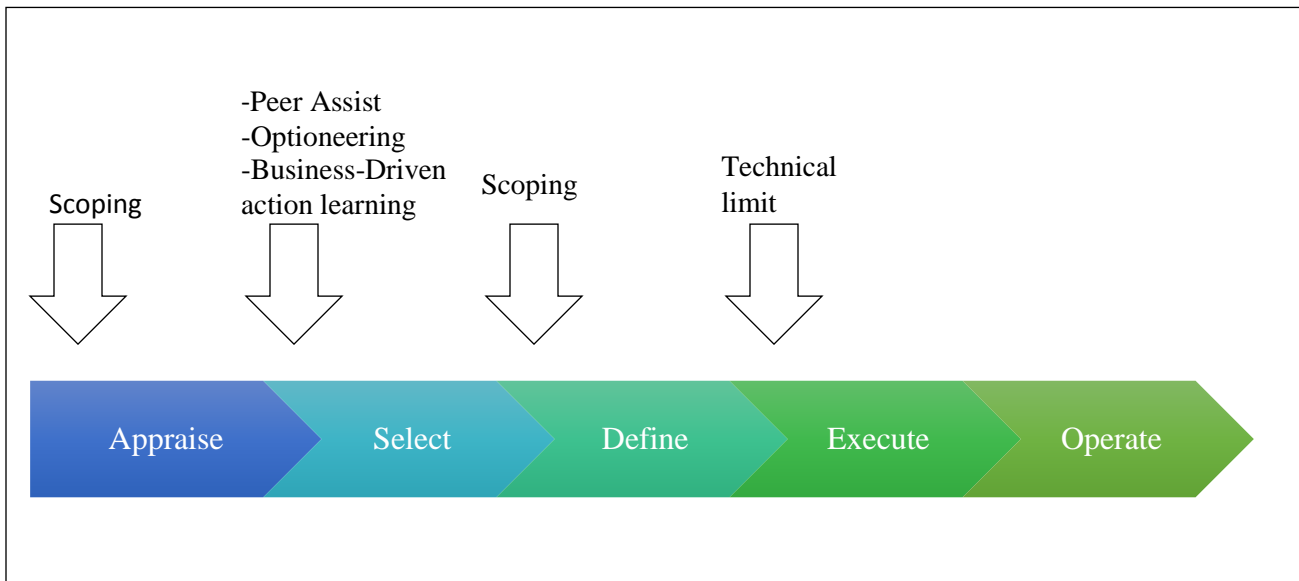
Figure 38: Potential learning before activities in the project stages (Milton 2005).

4.3.6 Knowledge sharing barriers

In this study, barriers to knowledge sharing within the sustainability department or within sustainability projects (at the individual level) are manifold. They include, (See figure 39)

1. Lack of time (5 firms expressed this)
2. Don't know who to share with (2 firms expressed this)
3. Don't know what to share (2 firms expressed this)
4. Different languages (3 firms expressed this)
5. Conception that knowledge is property (1 firm expressed this)
6. Lack of effective communication (1 firm expressed this)

Barriers to knowledge sharing at the organizational level include a culture, which does not create a climate of trust (2 firms expressed this). At the technological level, barriers that are associated with knowledge sharing include the lack of systems to support sharing (2 firms expressed this).
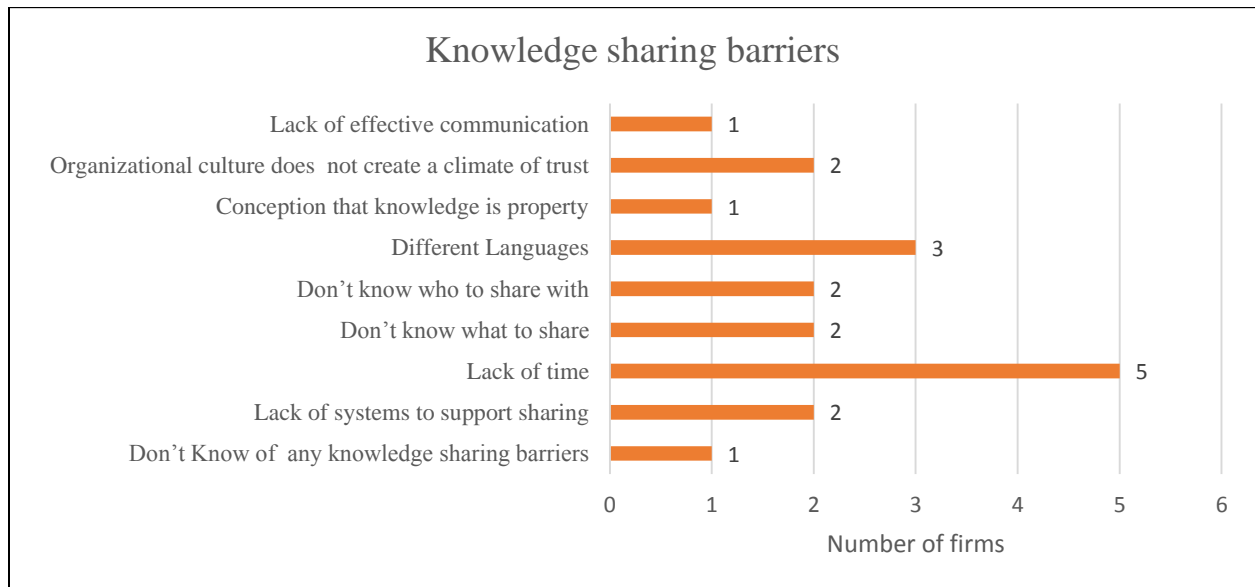
Figure 39: Knowledge sharing barriers

One of the key obstacles to knowledge sharing found in this study was the lack of time to share knowledge (5 firms expressed this concern). Literature on knowledge management also noted this concern with respect to other industries. Specifically, O'Dell and Grayon (1998) highlighted lack of time as a frequent barrier to knowledge sharing, concluding that even though managers know of the benefits that knowledge management could have in their firm, they sometimes struggle to implement it, due to time constraints. According to Michailove and Husted (2003), time restrictions are also a contributing factor to employees hoarding their information, as opposed to sharing knowledge with others (people naturally focus on tasks that are more beneficial to them). Time for knowledge sharing in this case can be seen as a costly factor. It

takes time to transfer knowledge from one employee to the next, or from one format to the next (e.g. from tacit knowledge to explicit knowledge) (Grant, 1996). Riege (2005) notes that it is important for work processes to allow for enough space for employees to be able to take their time to generate and share knowledge with others, and also to identify other staff members who may be interested in sharing their knowledge. A deficiency in formal and informal spaces where employees can interact with each other and share knowledge is a common problem (Gold et al. 2001). Several authors note the significance of formal and informal spaces in enhancing knowledge sharing and capturing processes, but too often, these spaces (formal and informal) are a rare commodity within companies because there is still a perception amongst many managers that if people are not busy doing something, then they are not being productive (Probst et al. 2000; Skyrme, 2000).

Only in 2 firms did the senior sustainability executives express that the organizational culture of their firms do not create a climate of trust. Several researchers have discussed knowledge-sharing barriers and have focused on the nature of companies' organizational cultures (e.g. De Long and Fahey, 2000; Mcdermott and O'Dell, 2001; Gurteen, 1999). Other researchers have centered their analysis on issues of trust amongst employees, and how it can impact the level of collaboration within an organization (e.g. Von Krogh and Roos, 1996; Tschanneh-Moran, 2001; Urch-Druskat and Wolff, 2001). Most employees are unable to share their knowledge without a feeling of trust-trust that other people will not misuse their knowledge (Riege, 2005). Sharing activities within an organization cannot be forced out of people or thoroughly supervised (Stauffer, 1999), but the level of trust between a company's leadership and its employees has a direct impact on the communication flow, and thus the amount of knowledge sharing within and between business functions or subsidiaries (De Long and Fahey, 2000; McAllister, 1995).

Lack of effective communication was a barrier with respect to knowledge sharing. In one firm the senior sustainability executives express this concern. This may be a result of the dislocation of sustainability employees, as mining firms have several operations throughout the world.

115

Because staff members are located in different countries, misunderstanding of different cultural backgrounds, different languages and different time zones with unmatched working hours could affect knowledge flow. Maki, et al (2004) conducted a study on "communication and knowledge sharing in a decentralized organization." In their study, they found that two main reasons for communication and knowledge sharing issues were decentralization and delocation. Delocation reduced opportunities for employees to have formal and informal face-to-face interactions to get information with regards to expertise, while decentralization of organizational activities caused some co-ordination problems in communication (Maki, et al 2004). In the Maki, et al (2004) study, the usage of different information and communication applications reduced employees' need to travel, and made sharing of information faster. However, the use of regular telephone conference meetings could not substitute face-to-face meetings (Maki, et al 2004).   Employees interviewed in the study acknowledged the significance of face-to-face meetings in situations of complex knowledge sharing, or of getting to know and to understand each other's working methods (Maki et al, 2004).

The sustainability executives in this study expressed that "different languages" posed a problem to knowledge sharing. Most mining firms have sustainability projects spread out throughout several countries with varying cultures and language. According to Riege (2005), "obstacles related to national culture and language barriers have little relevance on a domestic scale but are certainly a factor that cannot be ignored by companies that rely on sharing practices between international subsidiaries, irrespective of their size" (Riege, 2005, pg. 24).

One firm surveyed in this study expressed that employees who perceived knowledge as their own property also posed a problem to knowledge sharing. In the old school thinking, where profitability is linked to an organizational output, knowledge hoarding as opposed to knowledge sharing was believed to benefit ones career (Riege, 2005). Sharing of knowledge with other peers was regarded as weakening employees' power and status within a company (Probst et al, 2000;

Tiwana 2002). Lower and middle employees would often intentionally hoard their knowledge, expecting employees to promote them if they appeared more knowledgeable than other staff members (Riege, 2005). Other employees hoard their knowledge to receive recognition from colleagues or peers (Arvenpaa and Staples, 2001; Murray, 2002; Rowley 2002). In general, employees would feel a risk when it comes to the sharing of knowledge, as individuals are commonly rewarded for what they know and not what they share (Dalkir, 2011). As a result of such knowledge hoarding, this leads to negative consequences such as reinvention of wheels, feelings of isolation and resistance form ideas from outside an organization (Dalkir, 2011). One way to combat this issue is to stop rewarding knowledge hoarding and start providing valued incentives for knowledge sharing (Dalkir, 2011).

4.4 Knowledge Application

      4.4.1 Knowledge Reuse

In the mining industry, most sustainability-related work is undertaken in the form of projects. Sustainability project teams are composed of employees with varying degrees of knowledge and skill in different areas. Most projects are temporary in nature and teams are sometimes set up for a limited time, resulting in members leaving the project within its duration. When team members work on one sustainability project, leave and start working on other projects, they sometimes take their experiences with them without providing their key insights to a central knowledge base. In this study, we asked the sustainability executives whether their firm encourages employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-hashing what has been developed or solved. From our findings, 13 firms indicated that they encourage employees to reuse knowledge in order to prevent reinventing the wheel. From the firms surveyed, only one firm indicated that they don't encourage the reuse of knowledge.

Specifically, Company N commented that "innovations adding up to efficiency and effectiveness is welcome." Company E commented that, "it is a common practice for employees in the firm to

learn from others work/leverage past experiences. The firm often uses a pilot approach model, wherein one site tests an approach, and if successful, is then shared with other sites"

By being able to reuse knowledge effectively, this results in less repeating of the same mistakes, preventing reinventing the wheel or preventing performing redundant work (Schacht and Madche, 2013).

The 3 major steps of the integrated KM cycle (knowledge capture and /or creation, knowledge sharing and dissemination and knowledge acquisition and application) are supported by an infrastructure of organizational culture, KM team, KM tools and technologies, KM strategy and KM matrices to better help an organization manage knowledge effectively and efficiently.

4.4   Organizational culture
4.5.1 Relationship between organizational culture and knowledge sharing

In this study, we sought to find out the nature of knowledge culture within the sustainability departments of the mining industries explored. From the findings (see figure 40), 10 firms expressed that knowledge sharing is the norm in their organizational culture. Knowledge is something people feel they should share. From the firms interviewed, 3 firms expressed that knowledge sharing and learning from others is a neutral behavior. It is seen as neither desirable nor undesirable. It occurs on some areas of the organization, but not others. Lastly, one firm expressed that the behaviors and attitudes of the management and employees are not supportive to knowledge sharing; there is internal competition within the organization. From our results, we can clearly see that knowledge sharing is a norm – suggesting a cultural theme- but why is the managing of knowledge not as prevalent?. According to Yelden and Albers (2004), many companies are reluctant to undertake knowledge management initiatives because of the difficulty in establishing a sound business case. The difficulty in establishing a business case for knowledge management programs is really an issue of cause and effect, and often stems from the

fact that, since knowledge is intangible, there is no direct link from a knowledge management process to a demonstrable business outcome (Yelden and Albers, 2004).
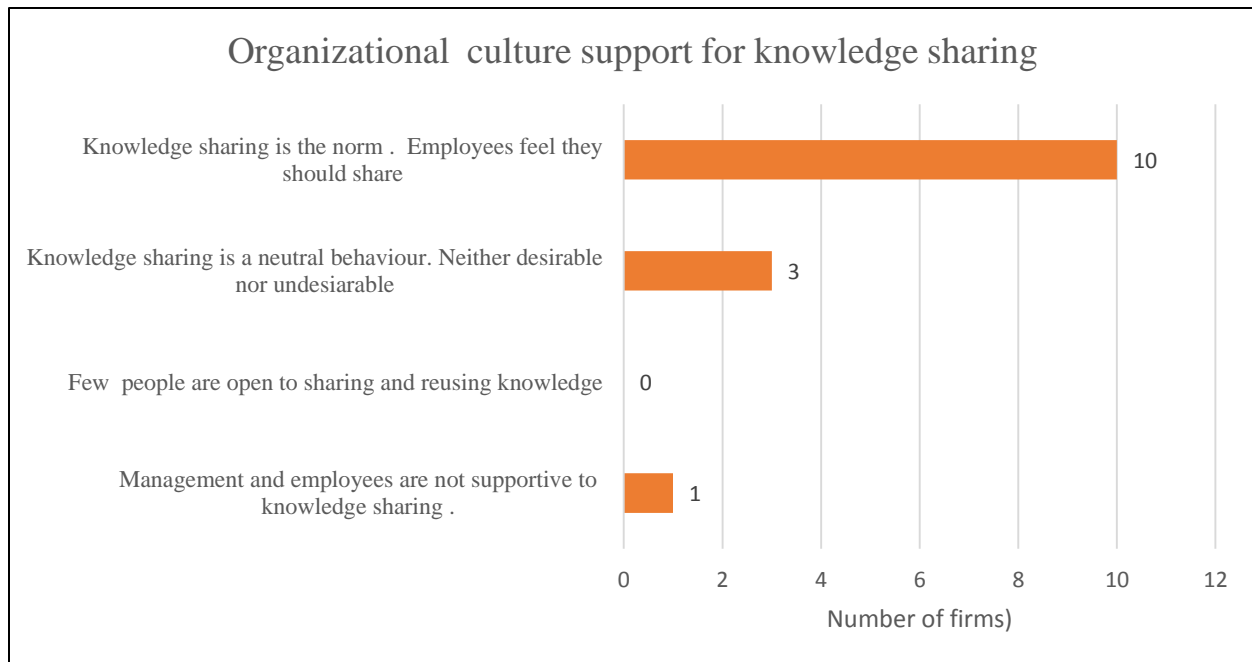
Figure 40: Organizational culture support for knowledge sharing

In this study, we asked the sustainability executives to rate the following factors (organizational culture encouragement of innovation and continuous improvement, reward structure, openness/transparency, trust, communication, and top management allocation of resource for knowledge sharing) with respect to their importance in the success of knowledge sharing. The findings (see figure 41), show that the sustainability executives felt that the organizational culture's encouragement of innovation and continuous improvement, reward structure, openness/transparency, trust, communication, and top management allocation of resource for knowledge sharing are "important" or "very important" to knowledge sharing.
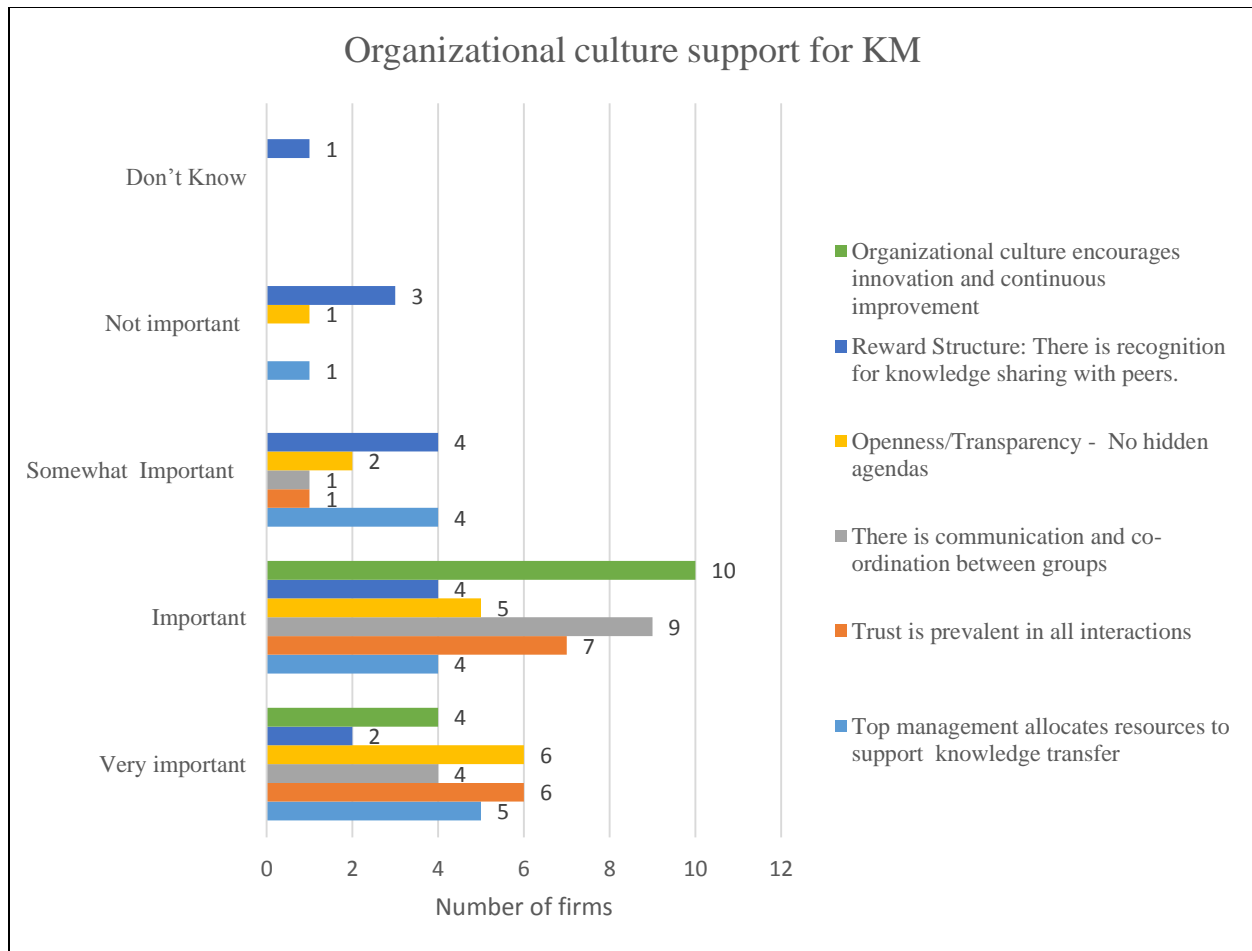
Figure 41: Organizational culture support for KM

In most of the cases in this study, the incentives to participate in KM were either informal or indirect. However in certain firms, especially in company J's sustainability department, job responsibilities include participating in CoP's. With most firms in this study, the incentives to participate in KM were either informal or indirect. Moreover, in most of the firms, financial incentives were considered "important" or "very important" to knowledge sharing but not implemented.

Most of the organizations interviewed in this study expressed that they are trying to develop a strong culture that is supportive of KM. This will require building strong organizational system

and processes that value the importance of KM. An example of an extractive sector firm that recognized this (although not interviewed in this study) is BP (Grant, 2013). One of the primary tasks of the BP KM team is to visit each business unit around the world (from exploration to sustainability) and create awareness and develop expectations across the company (Grant, 2013). Each visit consists of presentations and discussions with key staff, focusing on the importance of knowledge as a strategic asset and highlighting where knowledge management is already being successfully applied in the organization (Grant, 2013). By doing this, this not only creates an understanding of the KM process, challenges and opportunities but it also facilitates a culture that is conducive to the management of knowledge and signals the leadership's interest in it (Grant, 2014).

4.5.2 Barriers to a cultural change needed for KM to succeed

Cultural change required for KM to succeed is often thwarted by several barriers, including lack of common language, lack of adsorptive capacity, and lack of time. In this study, we asked the sustainability executives to give their opinions on what they felt to be the barriers to a cultural change needed for KM to succeed in their organization (see figure 42).
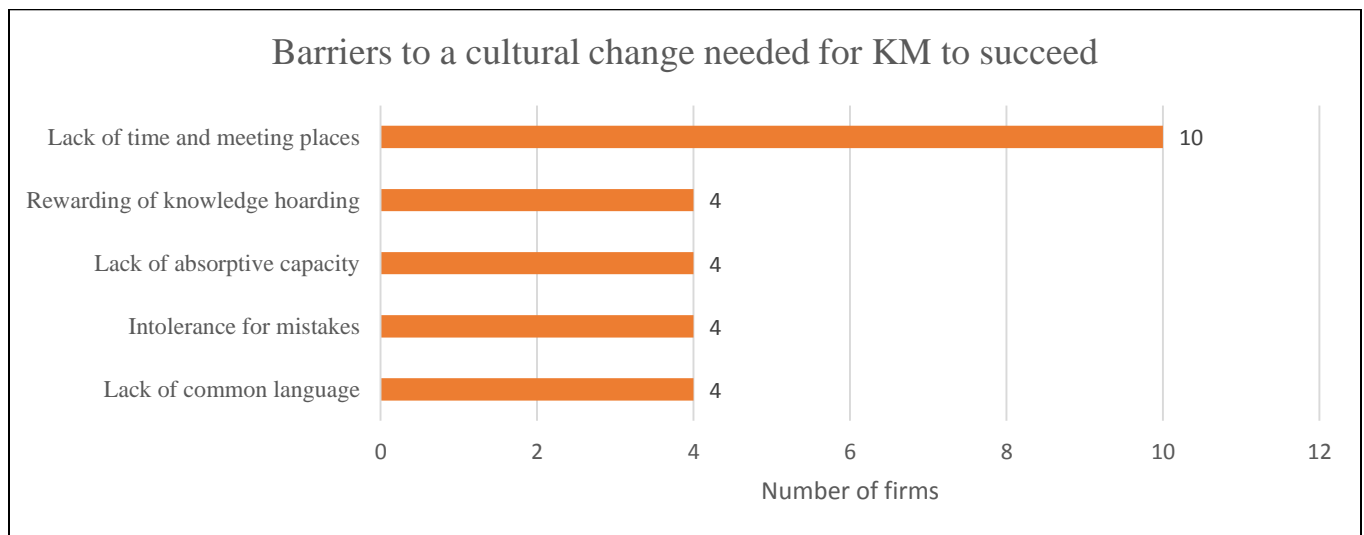
Figure 42: Barriers to a cultural change needed for KM to succeed. *Please not that some firms had multiple responses.*

121

The above findings show that lack of time and meeting places constitute major barriers to the cultural change needed for KM success (10 firms expressed this). According to Dalkir (2011), cultural change is thwarted by the lack of attention to some basic requirements, such as providing staff members with knowledge sharing meeting places, and legitimate time to spend in such meeting places. Managers should be able to encourage employees to take advantage of knowledge sharing meeting places so that employees can exchange ideas with one another. KM activities should be integrated with the daily work of staff members. It should not be done in the employees' spare time, which would convey KM activities as peripheral, secondary or "hobby-type" activities in comparison to "real work" (Dalkir, 2011).

The rewarding of knowledge hoarding is another barrier to the cultural change that's needed for effective KM implementation (4 firms expressed this). In many organizations, recognition, performance appraisals and promotions are all linked to what has been accomplished by being the first and only one with new idea, product or process (Dalkir, 2011). If employees hoard knowledge for the sake of rewards, then cultural change will not occur (Dalkir, 2011). In order to bring about the cultural change needed for effective KM implementation, it is important for managers to integrate knowledge sharing behaviors in performance evaluation criteria (Dalkir, 2011). Management should additionally reward good teamwork, collaboration and knowledge reuse whenever possible (Dalkir, 2011).

Of the firms interviewed, 4 firms expressed that a lack of absorptive capacity was also a barrier to the cultural change needed for KM implementation. An absorptive capacity refers to "the individual and/or organizational openness to change and innovation and the capability or preparedness for being able to integrate it" (Dalkir, 2011, pg. 260). If an organization has a low absorptive capacity, it may be difficult for that organization to carry out any cultural changes (Dalkir, 2011). One possible solution that a firm could employ is to augment its employee base by recruiting individuals who are selected for their eagerness to learn, their openness to new

ideas, and their innovativeness in approach (Dalkir, 2011). Another solution is to provide existing employees with awareness seminars, creativity building workshops such as "thinking out of the box approaches," and other training opportunities in order to give them an opportunity to reframe their perception of themselves and of the planned cultural changes to the firm (Dalkir, 2011).

Change in any organization can be hindered if any employee's motive to request help from other employees is perceived as undesirable behavior by others, or as a manifestation of weakness (Dalkir, 2011). If employees are expected to know all the answers at all times, and by asking for assistance, this may portray that a staff member is not qualified for the job, then no one will ask any questions In this study, 4 firms expressed that intolerance for mistakes, and need for help and trust is a contributing barrier to a cultural change. Such firms should be able to have a reward system that actively promotes, supports and values interactions for help and knowledge sharing (Dalkir, 2011). Additionally, management should be able to ensure its employees that there will be no loss of status for not knowing everything. Concurrently, employees who provide knowledge and assistance should be rewarded (Dalkir, 2011).

Another barrier to the cultural change needed for KM to succeed lies in the lack of a common language amongst staff members. In this study, 4 firms expressed that point. When we talk of lack of a common language, we are talking of shared technical or professional languages (e.g. Environmental Scientist/Engineer speak vs. Mine Manager speak) that can cause a lot of confusion in the workplace (Dalkir, 2011). This kind of cultural barrier change can be overcome by establishing a knowledge taxonomy, and knowledge dictionary for knowledge content, standard formats, translators, metadata, and knowledge support staff (Dalkir, 2011).

4.6 Knowledge management roles

KM professionals in general should be proficient in retrieving information, evaluating/assessing information, organizing, and analyzing content and presenting content (Dalkir, 2011). In this

study, we sought to explore the existence of KM roles in the sustainability departments of the mining firms explored. (See figure 43). Of the mining firms interviewed, 8 firms expressed that there are no KM roles in the sustainability department, while 4 firms expressed that some KM roles are laid out within the sustainability department (for example, CoP leaders, CoP facilitators, and knowledge brokers). Only one firm expressed that knowledge roles are established within the sustainability department.
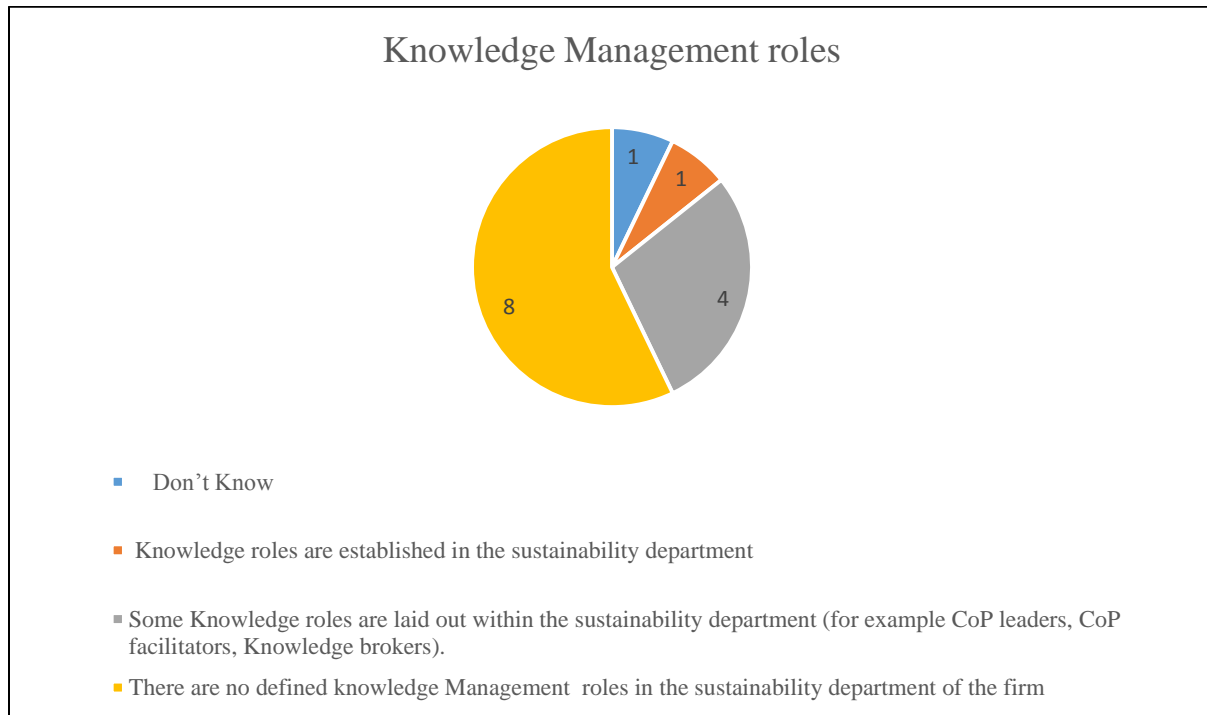
Figure 43: Knowledge Management roles. *Each number in the pie chart represents the number of firms.*

From the findings, it is evident that KM roles are lacking in 8 of the firms that participated in the study. Establishing KM roles within the sustainability department is important for the successful implementation of KM. KM roles need to be established in order to ensure that mining firms KM goals are in line with the strategies and objectives of the firm, and that the firm acts like a learning organization, improving over time with the help of best practices and lessons learned. The KM skills required to successfully carry out KM roles vary from business awareness and

expertise, management skills, information management, and information technology expertise (Dalkir, 2011).

Specialist recruitment, advisory and research firms that focus on KM and Information management consulting, such as TFPL with offices in London, England, can be useful in working with organizations in both the public and private sector to help develop and implement knowledge and information strategies, and to help recruit and train information leaders and their teams (Dalkir, 2011). TFPL developed a KM skills map that was based on an extensive international search of over 500 organizations involved in implementing KM (Dalkir, 2011). See Appendix 5 for an excerpt of the TFPL KM skills map.

4.7 Knowledge management tools and technologies

In this study, we asked whether there were any technologies to support the management of sustainability knowledge. From the findings, 5 firms expressed that there is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organization. But it's by no means easy or possible to share and to find knowledge across the entire firm. Of the firms interviewed 3 firms expressed that some limited technology infrastructure exists, such as search engines and emails, but nothing for effective collaboration, networking or sharing. Similarly, 3 firms expressed that that the technology infrastructure largely supports KM, but some barriers still exist for effective networking, publishing and finding published knowledge or knowledgeable people. Only two firms stated that there exist various technologies for all employees to capture, share, and apply knowledge. Additionally, one firm expressed that there is no technology available for creating, sharing and applying knowledge (See figure 44).
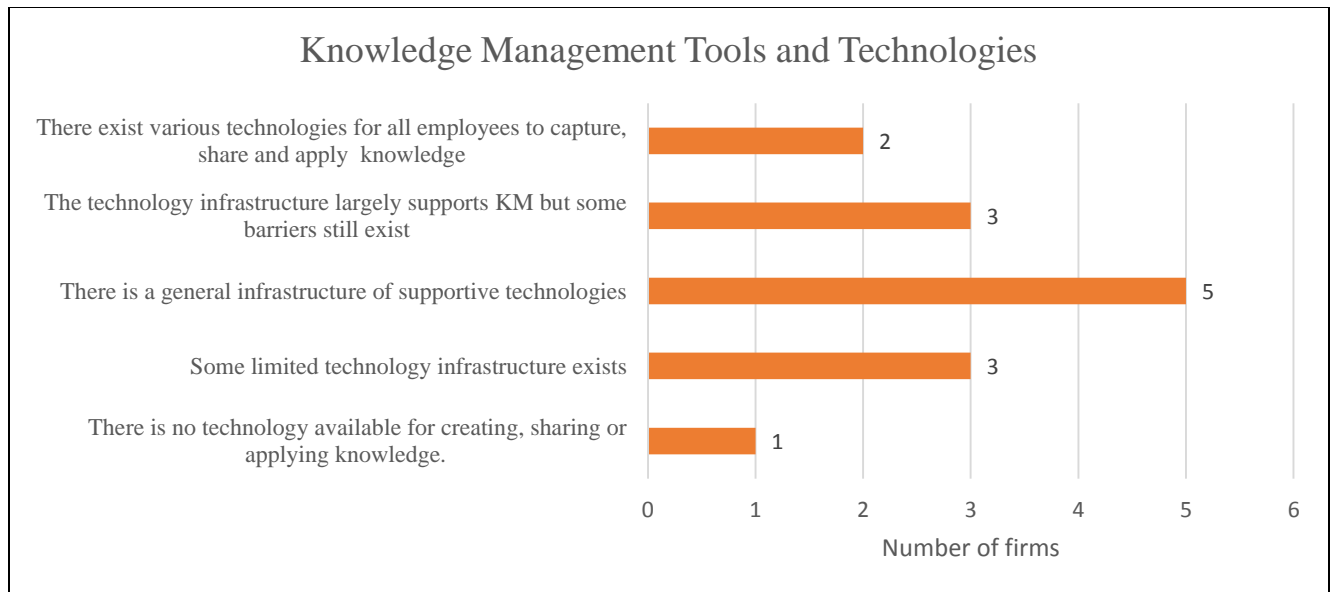
Figure 44: Knowledge Management Tools and Technologies

From the findings, we can clearly see that there is a lack of effective technologies for the sharing of knowledge. There exists a wide range of diverse KM technologies that can be used to support knowledge sharing and dissemination (See table 16). Sustainability departments in mining firms need to understand that the underlying theme of KM technologies is that of a toolkit. Several technologies and tools for sharing, capturing and applying knowledge are borrowed from other disciplines and are specific to KM (Dalkir, 2011). It is imperative for all technologies and tools to be mixed and matched in the appropriate manner in order to address the KM needs of the firm (Dalkir, 2011). The choice of the tools to use in the KM toolkit should be consistent with the overall business strategy of the firm (Dalkir, 2011).

4.8 Knowledge management strategy

Many Knowledge management academics have stressed the importance of linking business strategies to knowledge management (Clarke, 2001; Maier & Remus, 2002). Additionally, business academics and economists have long stressed the internal role knowledge plays in

business strategy and organizational performance (Davenport and Laurence Prusak, 2000). In this study, we examined how closely KM is linked to the business strategy of the firms explored. From the findings, 8 firms said that some business areas or projects have defined critical knowledge areas, which they manage. Additionally, 2 firms expressed that knowledge management is fully fixed into the business strategy, while 4 firms expressed that knowledge management is not linked to the business strategy of the firm (See figure 45).
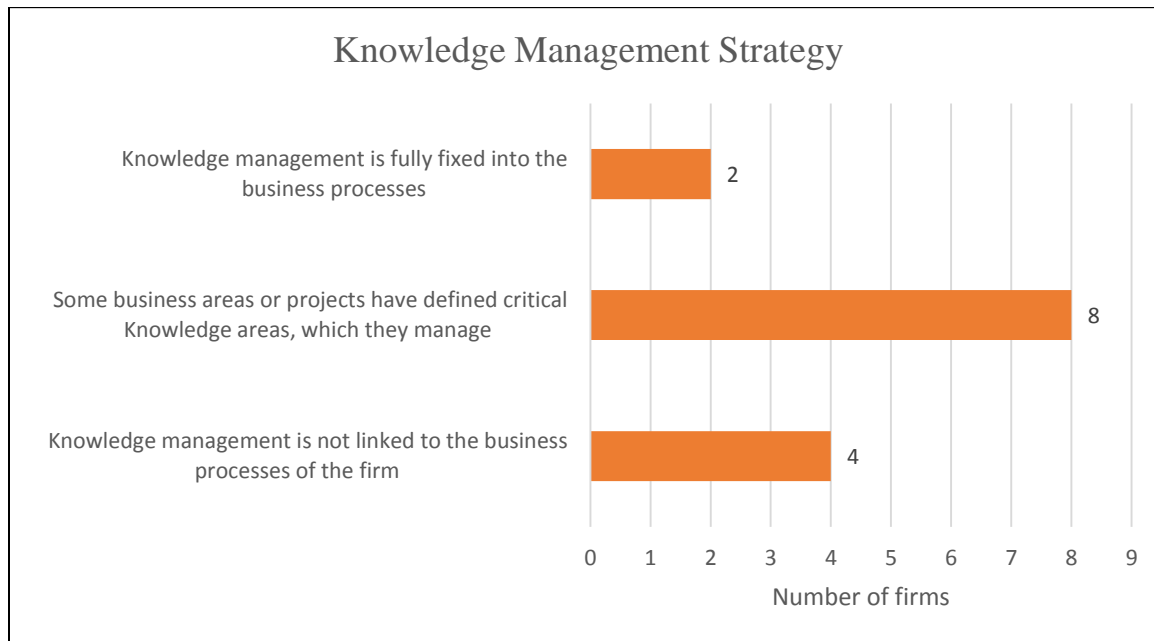
Figure 45: How closely is KM linked to the business strategy

Most organizations (12 of the mining firms -some of which include 4 of the firms surveyed in this study whoo expressed that knowledge management is not linked to the business strategy of the firm) acknowledge the significance of KM in leveraging their knowledge assets for competitive advantage and improved performance. Most firms do not attain the required performance levels even when KM programs are in place for managing knowledge resources (Dion et al, 2010). Research suggests that this shortcoming can be resolved by linking knowledge management to the business strategy (Dion et al, 2010).

However, most organization may ask this question "how can knowledge management be linked to strategy when knowledge isn't the product?" (Davenport and Laurence Prusak, 2000). According to Davenport and Laurence Prusak (2000), assuming a company has a well-defined strategy, the trick is to figure out how to support and enhance that strategy through knowledge management. So if a company is driven by new products and services, then the company's strongest KM efforts should probably be devoted to managing research knowledge (Davenport and Laurence Prusak, 2000). According to Davenport and Laurence Prusak (2000), it's not difficult to envision ways of using knowledge more effectively in business strategy. The difficulty however lies in making the changes to strategic programs and adopting the necessary behaviors throughout an organization (Davenport and Laurence Prusak, 2000).

4.9 Knowledge management metrics

There are a variety of methods that can be used to evaluate how well KM is succeeding (milestone and formative evaluation) and how well KM has helped an organization attain organizational goals (outcomes and summative evaluation) (Dalkir, 2011). This includes balance scorecard method, result-based metric, benchmarking and house of quality matrix. Each method presents its advantages and disadvantages and often a combination of different measures may be called for. In this study, the firms that did measure their knowledge used various combinations of monitoring tools (See figure 46).

Figure 46 - Monitoring of how well KM is succeeding and how well it has helped attain organizational goals. *Please note that some firms had multiple responses.*

Most of the organizations interviewed (10 firms) expressed that monitoring of knowledge is not done. In practice very few organizations have the luxury of allocating resources to implement something without being required to know its value i.e. the cost associated with KM are easy and visible to measure, however the benefits tend to be intangible, opaque and much more long term in nature (Dalkir, 2011, NHS, 2005). This makes the return on investment (ROI) of knowledge management more difficult to assess (Dalkir, 2011). However, it has to be made clear that without measurable success, the enthusiasm and support for KM may cease to exist. Additionally, without measurable success, it will be hard for companies to manage performance proactively.

CHAPTER 5: RECOMMENDATIONS

This chapter of the thesis sets out recommendations (citing relevant sources) to better improve sustainability knowledge in the mining firms explored. The recommendations are intended to provide sustainability executives with an overview of the key steps required in applying KM to better manage sustainability knowledge.

5.1 KM strategy

In this study, we examined how closely KM is linked to the business strategy of the firms explored. Of the mining firms interviewed, 4 firms expressed that knowledge management is not linked to the business strategy of the firm. For mining firms that do not have a KM strategy, it is first recommended to map out the current KM state of the organization before developing a KM strategy, as a good strategy will identify the existing KM status of an organization, compare this existing status with what stakeholders want to achieve in the future and finally come to an assessment of how far apart the gap is (gap analysis)(Dalkir, 2011). The mapping out of the current KM state of an organization i.e. knowledge intensive resources that exist in the firm, can be achieved through auditing. According to Dalkir (2011) a knowledge audit can produce the following types of results:

- Identification of core knowledge assets and flows—who creates, who uses.
- Identification of gaps in information and knowledge needed to manage the business effectively.
- Areas of information policy and ownership that need improving.
- Opportunities to reduce information-handling costs.
- Opportunities to improve coordination and access to commonly needed information.
- A clearer understanding of the contribution of knowledge to business results.

Fahey & Prusak (1998) developed a set of questions that could be used for an audit.

- Which individuals play what roles in developing and testing information?

130

- Which individuals, or categories of individuals, are not involved in dialogue around specific issues and topics? How might their involvement affect the content and flow of knowledge?
- How is knowledge flow facilitated or impeded by the organization's structure and systems?
- How does tacit knowledge influence the generation and transfer of explicit knowledge?
- How is technology used to unearth and influence tacit knowledge?
- What role do experiments play in knowledge generation?

There are however several audits that are suggested among the KM literature. It is important for a mining firm to engage in critical, sustained, and honest self-reflection about the current way in which knowledge is managed.

A gap analysis that examines the difference between the organization's existing KM status and desired KM state should be analyzed in terms of enablers and barriers to successful KM implementation. According to Zack (1999) and Skyrme (2001) a good gap analysis should address the following points:
- What are the major differences between the current and desired KM states of the organization?
- Lists barriers to KM implementation
- List KM leverage points or enablers
- Identify opportunities to collaborate with other business initiatives (e.g., combine knowledge continuity goals with succession planning initiative in Human Resources).
- Conduct a risk analysis (e.g. knowledge loss due to human resource attrition)
- Are there knowledge silos (e.g., groups, departments, or individuals that hoard knowledge or block fluid knowledge flows to other groups, departments, or colleagues)?
- How does the organization rank with respect to others within the industry?

It is then recommended to have a short term, (one to three years) action plan, that includes, costs, resources and measuring components (Dalkir, 2011). It is imperative for KM to be linked to the business strategy of the firm. Many knowledge management academics have stressed on the importance of linking business strategy to knowledge management (Clarke, 2001; Maier & Remus, 2002). The success of the KM plan/strategy will heavily depend on the support of senior managers who are "knowledge champions" who are convinced of the benefits of KM (Jones et al 2003).

5.2 Knowledge capture and/or creation

From the findings of this study, 8 firms capture sustainable tacit knowledge at the individual and group level via "learning by observation." Of the mining firms surveyed, 7 expressed that they capture sustainable tacit knowledge through learning by being told. Additionally, 6 mining firms surveyed relayed that they capture tacit knowledge via "interviewing experts. Lastly, of the mining firms interviewed, 4 relayed that there had been no formal processes to capture sustainable tacit knowledge.

It is imperative to note that no one single approach (interviewing experts, learning by being told and learning by observation) should be used in total exclusion of the others, thus we recommend that a combination of all techniques to be used in order yield greater capturing of sustainable tacit knowledge.

For the 4 firms that expressed that they don't have any formal process to capture sustainable tacit knowledge, it is recommended for them to;

a) Recognize the source of knowledge to capture (Hari et al, 2005).
b) Examine the knowledge to be captured (Hari et al, 2005). This can be done through establishing a strategy and objectives for knowledge capture in the organization;

determine the competences and capabilities of the organization; and identify deficiencies and gaps in the organization (Hari et al, 2005).

c) Implement techniques and tools to capture knowledge. Techniques to capture tacit knowledge at the individual and group level include; learning by observation, learning by being told and interviewing experts. Other methods to capture tacit knowledge from individuals and groups include; ad hoc sessions, road maps, learning histories, action learning, e- learning and learning form benchmarking against industry practices. At the organizational level, tacit knowledge techniques that could be used include; inferential processes, experimental learning, vicarious learning and grafting. When it comes to employing techniques capture knowledge at the individual, group level or organizational level, it is imperative to note that no one approach should be used in total exclusion of the others, thus a combination of all techniques would yield greater capturing of sustainable tacit knowledge.

5.2.1 Explicit knowledge codification

When it comes to codifying tacit knowledge at the individual or group level into an explicit form that is amenable for easy transfer and ready to be used by other staff members, the most concerning finding was that 8 mining firms do not codify their tacit knowledge into an explicit form that is visible, accessible and usable for decision making. Firms that fail to codify their knowledge miss on the opportunity to convert valuable tacit sustainability knowledge into the form of a document, which can be communicated easily and with less cost for the firm. They also miss on the opportunity to build efficient, productive, and valuable knowledge bases and applications (Awad and Ghaziri, 2001). Additionally, such organizations miss on the competitive advantage of reducing the dependence on human experts who are expensive, hard to come by, and mortal (Awad and Ghaziri, 2001). Lack of resources or time could be the underlying reasons why explicit knowledge codification is not prevalent. Before codifying knowledge, it is important for the sustainability department to ask what organizational goals the codified knowledge will serve. Several tools to codify tacit knowledge into an explicit form can be

133

utilized. Such tools include case based reasoning, production tools, decision tables, frames, decision trees and cognitive maps.

5.2.2 Storage and access of explicit codified knowledge

When surveying the mining firms to ask how they store and access explicit codified knowledge, 4 of the firms expressed that they do not store explicit codified sustainability knowledge (no records held) at all. Firms that fail to store codified explicit sustainability knowledge lose out on building corporate memories of important information, including best practices, lesson learned, technical and managerial performance data, etc. Additionally, if no records are held, or if there is a poorly constructed knowledge-storing infrastructure within the firm, then the ability of valuable sustainability knowledge to be shared amongst organizational members is eroded. It is recommended that firms have databases on best practices and lessons learned. This databases should be easily accessible and continuously renewed/refined in order to avoid information from being out of date (obsolete). Additionally databases should be easily accessible for use by organizational members

5.2.3 Project knowledge retention

Knowledge is a significant resource absolutely essential for any on-going project in an organization (Srikantaiah et al., 2010). The ability to manage knowledge in projects is imperative not only to the success of the project itself, but also to the creation of best practices and lessons learned which would ensure organizational continuity and sustainability (Srikantaiah et al., 2010). In this study, one firm firms expressed that they never have project close out meetings, and nor do they usually document "lessons learned " as a means of passing along the things that worked or didn't work on a project. Additionally 7 firms indicated that they seldom have project close have project close out meetings, and nor do they usually document "lessons learned " as a means of passing along the things that worked or didn't work on a project.

134

It is recommended for knowledge to be managed effectively within projects so that mistakes are not repeated and project team members are not constantly re-inventing the wheel. Project closeout meetings are a great way of retaining lessons learned at the end of a project and storing that knowledge in a database. Knowledge management could be applied to mining sustainability projects as it has great potential to add value at all project stages (initiation, planning, execution, and closure). KM situated in the context of a project carries several benefits, one of them being that a project on its own is an effective community of practice with better familiarity and relationships amongst groups of people. Additionally, in projects (in comparison to KM in organizations) it is much easier to measure KM parameters and to correlate them with cost, quality, and productivity measures (Srikantaiah et al., 2010).

Srikantaiah, et al (2010) shows some of the recommended KM practices that can be employed in the various stages of a project.
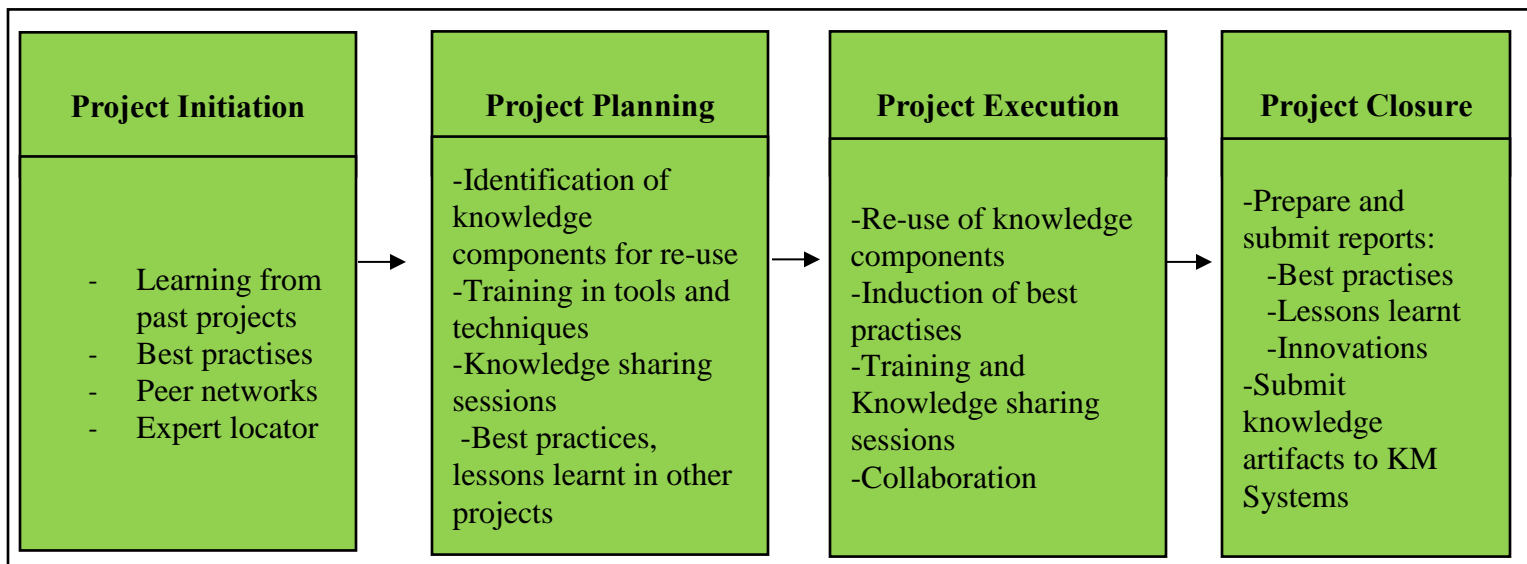
Figure 26: Recommended KM practices at various stages of Projects (Srikantaiah et al., 2010).

5.2.4 Managing knowledge loss

In the context of preventing the loss of sustainability knowledge due to human resource attrition we asked mining firms whether they employed any techniques to preempt the risk of losing vital sustainability knowledge from departing employees. Of the mining firms surveyed, 6 firms indicated that structured exit interviewing was used. Structured interviews are typically based on capturing, codifying, and storing the knowledge of the departing staff member (including lessons learned and best practices in projects where he or she was a key member). According to Parise et al (2006), structured interviews are helpful, but often lead to two serious problems;

3) First, just because knowledge has been captured from departing staff, codified and stored into a database, does not mean that the knowledge will ever be found and interpreted into the right way, or even given enough credibility to be used. In addition, knowledge retention processes like structured interviews only capture a small fracture of what made an individual successful or knowledgeable to begin with. Staff who leave a company may take many kinds of knowledge with them, including subject matter expertise and organizational memory of why vital decisions were made (the results which may never have been documented)

4) Second, knowledge retention processes such as structured interviews sometimes focus on a person's knowledge independent of the networks or relationships that were important in getting the work done. As work in a firm gets more complex, staff members rarely accomplish anything of substance by themselves and rely on other workers or external parties for help. Few knowledge retention techniques take into account this network-based approach. When employees leave, they not only depart with what they know, but with who they know. A study by Cross and parker (2004) demonstrated that such relationships are very important sources of information and performance in an organization. An employee who has over 10 years of work experience in a particular firm cannot be replaced with another employee with the same skills without incurring disruptions in the web of formal and informal relationships that get the actual work done.

136

It is therefore recommended to use Organizational Network Analysis (ONA) as proposed by (Parise et al. 2006) in order to uncover important employee relationships and avoid critical disruption. ONA can highlight the unique knowledge that is held by three types of employees: central connectors, brokers, and peripheral players (Parise et al .2006). Once a firm has identified employees' relationships in the categories of central connectors, brokers, and peripheral players, they can take the following corresponding actions to prevent the knowledge loss. Such a process would need to be supported by top management. [Table 14 is adapted from Parise et al (2006)].

Network Role	Knowledge –Loss Risks	Actions
Central Connector	• Technical expertise and organizational memory as well as a set of relationships that help many others get information or other resources to do their work. •Experiential knowledge and reputation that enable rapid onboarding of new employees.	• Use personal network profiles in career development and onboarding practices to create network redundancies systematically where departures might dramatically fragment a network. • Reallocate information access and decision rights to ensure that one point does not become too vulnerable in the network. • Have central connectors lead communities of practice as a means of creating connections around them. • Require central connectors to

		help newcomers get acclimated through strategic introductions, "shadowing," mentoring and joint projects.
Broker	•Broad knowledge of how the organization operates and ability to recognize opportunities that require integration of disparate expertise. • Ability to mobilize and coordinate efforts of disparate groups to pursue those opportunities.	• Identify and develop brokers through staffing and rotation across division, geographic and expertise groups. • Assign brokers strategically where information gaps exist or where ideas can move from concept to action. • Give brokers preauthorized decision limits to tap into network resources. Allow them to experiment to obtain real-time information.
Peripheral Player	•Niche (and often marginalized) expertise or early-adopter ideas that have the potential to reshape offerings or operations. •Set of external relationships built on trust and familiarity.	•Ensure relevant peripheral people are visible and engaged, for example, by encouraging their hosting of "lunch-and learns" and webcasts. •Invite external partners to conduct workshops and attend meetings to broaden the network.

		•Reward employees for bringing external ideas and connections into the organization.

Table 14: Knowledge – retention strategies by network roles (Parise et al .2006).

5.3 Knowledge Sharing

5.3.1 Sharing of sustainability knowledge through Communities of Practice (CoP)

In the mining industry, CoP is the most widely and enthusiastically used KM tool (Grant, 2013). However some firms fail to fully utilize it, i.e. 2 firms expressed that COP's are rare in the sustainability department. Additionally, one firm expressed that CoP's does not exist.

The following recommendations are put forth for firms that don't have established CoP's

a. Top management should ensure that the culture of the organizations supports knowledge sharing.

b. Knowledge sharing roles should be embedded within the roles of staff. Employees should be given the time to fulfill their knowledge sharing roles and responsibilities

c. Valued incentives to knowledge sharing should be provided

d. Cop should exist throughout the sustainability department, maintained and monitored and used to add value to the department by sharing lessons learned

e. Techniques to share knowledge such as peer assist, CoP's, lesson leaned systems, writing case notes on successful and unsuccessful processes, brainstorming techniques, Quality circles, and mentoring and coaching should be encouraged in the firm.

f. Formal and informal spaces where employees can interact with each other and share knowledge should be created.

139

5.3.2 Visually mapping the relations between employees to identify knowledge flows

Visually mapping the relationship between people is an important process for the identification of knowledge flows (i.e. who people seek knowledge information from or who they share their information and knowledge with). In this study, it was found that visually mapping of the relations between employees within their respective sustainability departments within the mining firm is primarily done through organizational charts (6 firms expressed this). Of the mining firms surveyed, 9 firms expressed that the visual mapping of employee relations to identify knowledge flow is not done. Firms need to visually map the relationship between people in order to identify knowledge flows, i.e. who people seek knowledge information from or who they share their information and knowledge with. They can do so through the use of Social Network Analysis (SNA). According to Dalkir (2011), the use of organizational charts has limitations in the sense that they show only formal relationships (i.e. who works where and who reports to whom) (Dalkir, 2011). Social Network Analysis (SNA) on the other hand shows informal relationships, i.e. who knows whom and who shares information with whom (Dalkir, 2011). SNA, therefore, allow managers to better visualize and understand the many relationships between staff that can either impede or facilitate knowledge sharing (Anklam, 2003). This can help hasten the flow of information and knowledge across the organization

5.3.3 Sharing and maintaining best practices

Of the firms interviewed, 9 firms indicated "best practices is made available to a small portion of staff and not routinely updated." These 9 firms treated best practices as a static concept. It is recommended for firms to fully understand what best practices mean in the context of KM. In KM, best practices is a contentious term. Best practices ought to be viewed as temporary and contextual (i.e. there may be a current "best way" to do something), but like "world champion" or "world record," it's not going to stay the best for long (Milton, 2010). If an organization clings to a best practice, thinking it's *the* best, then they may be oblivious to the fact that such a "best practice" will soon be superseded. Many organizations use the term "best practice" as an excuse

not to learn. A best practice should be viewed as a starting point, with room for improvement. Best practices need to be dynamic and constantly updated to be able to innovate and improve beyond it.

5.3.4 The flow of knowledge within projects -learning before, during and after

This study explored the frequency of learning at the start, during and the end of a project. The findings show that learning within sustainability projects occurs to a lesser extent in the beginning (50% - firms), but rises a bit during (57%-8 firms), and after a project (64%-9firms). From these findings, it is clear that there is a need to manage knowledge and learning properly before the start of a project in order to access the knowledge that is needed. Learning before a project or activity can involve identifying the knowledge which will be useful to the project team on helping them deliver the project objectives, identifying the sources of that knowledge (both tacit and explicit), and doing something to bring the knowledge to the team"(Milton, 2005)

Milton (2005) offers various learning activities that could be used before each of the key project stages. (See figure 17). All of these learning activities can be applied to sustainability projects in the mining industry.

Finally, it is recommended that all knowledge sharing interactions be maintained at a professional level at all times and supported by top management.

5.3.5 Knowledge sharing barriers

In this study, one of the key obstacles to knowledge sharing found in this study was the lack of time to share knowledge (5 firms expressed this concern). Literature on knowledge management also noted this concern, specifically, O'Dell and Grayon (1998) highlighted lack of time as a frequent barrier to knowledge sharing, concluding that even though managers know of the benefits that knowledge management could have in their firm, they sometimes struggle to

implement it, due to time constraints. According to Michailove and Husted (2003), time restrictions are also a contributing factor to employees hoarding their information, as opposed to sharing knowledge with others (people naturally focus on tasks that are more beneficial to them). Time for knowledge sharing in this case can be seen as a costly factor. It takes time to transfer knowledge from one employee to the next, or from one format to the next (e.g. from tacit knowledge to explicit knowledge) (Grant, 1996). Riege (2005) notes that it is important for work processes to allow for enough space for employees to be able to take their time to generate and share knowledge with others, and also to identify other staff members who may be interested in sharing their knowledge. A deficiency in formal and informal spaces where employees can interact with each other and share knowledge is a common problem (Gold et al. 2001). Several authors note the significance of formal and informal spaces in enhancing knowledge sharing and capturing processes, but too often, these spaces (formal and informal) are a rare commodity within companies because there is still a perception amongst many managers that if people are not busy doing something, then they are not being productive (Probst et al. 2000; Skyrme, 2000). It is therefore recommended that formal spaces be created for employees to interact with each other and share knowledge.

Only in 2 firms did the senior sustainability executives express that the organizational culture of their companies do not create a climate of trust. It is recommended that top management foster a trusting environment for employees, as without trust, communication and teamwork will erode. This is imperative as sharing activities within an organization cannot be forced out of people or thoroughly supervised (Stauffer, 1999), but the level of trust between a company's leadership and its employees has a direct impact on the communication flow, and thus the amount of knowledge sharing within and between business functions or subsidiaries (De Long and Fahey, 2000; McAllister, 1995).

Lack of effective communication was a barrier with respect to knowledge sharing. In one firm the senior sustainability executives express this concern. This may be a result of the dislocation

of sustainability employees, as mining firms have several operations throughout the world. It is recommended that different information and communication applications be used in order to reduce employees' need to travel, and make sharing of information faster.

One firm surveyed in this study expressed that employees who perceived knowledge as their own property also posed a problem to knowledge sharing. In the old school thinking, where profitability is linked to an organizational output, knowledge hoarding as opposed to knowledge sharing was believed to benefit ones career (Riege, 2005). Sharing of knowledge with other peers was regarded as weakening employees' power and status within a company (Probst et al, 2000; Tiwana 2002). Lower and middle employees would often intentionally hoard their knowledge, expecting employees to promote them if they appeared more knowledgeable than other staff members (Riege, 2005). Other employees hoard their knowledge to receive recognition from colleagues or peers (Arvenpaa and Staples, 2001; Murray, 2002; Rowley 2002). In general, employees would feel a risk when it comes to the sharing of knowledge, as individuals are commonly rewarded for what they know and not what they share (Dalkir, 2011). As a result of such knowledge hoarding, this leads to negative consequences such as reinvention of wheels, feelings of isolation and resistance form ideas from outside an organization (Dalkir, 2011). It is recommended that firms stop rewarding knowledge hoarding and start providing valued incentives for knowledge sharing (Dalkir, 2011).

5.4 Knowledge application

The following activities are recommended for knowledge application;

a) Best practices and lesson learned need to be made available to all other sustainability staff members via the knowledge base (Dalkir, 2011).

b) A Corporate yellow page could be created in order for sustainability staff to find out who is knowledgeable in which areas of expertise (Dalkir, 2011).

c) Knowledge management systems should be in place to provide support for many information functions such as

143

- Acquiring, indexing, capturing and archiving
- Finding and accessing
- Creating and annotating
- Combining collecting and modifying
- Tracking (Edmonds and Push, 2002).

d) Employees should be encouraged to reuse knowledge to increase efficiency as opposed to re-inventing what has been developed or resolved.

e) Top management should ensure that the organizational culture in the sustainability department facilitates key phases on the KM cycle such as capturing, creating, sharing, disseminating, acquiring and applying valuable knowledge.

5.5 Organizational culture

This study examined the nature of knowledge culture within the sustainability departments of the mining industries. From the findings, one firm expressed that the behaviors and attitudes of the management and employees are not supportive to knowledge sharing; there is internal competition within the organization. It is therefore recommended that:

a. Top management should allocate resources to support knowledge transfer.

b. Top management should implement a strategy to build a trust culture that facilitates openness and transparency in the sustainability department.

c. Communication and co-ordination between groups should be encouraged

d. Top management should ensure that the organizational culture encourages innovation and continuous improvement.

e. Managers should be able to encourage employees to take advantage of knowledge sharing meeting places so that employees can exchange ideas with one another.

f. KM activities should be integrated with the daily work of staff members. It should not be done in the employee's spare time, which would convey KM activities as peripheral, secondary or "hobby-type" activities in comparison to "real work"(Dalkir, 2011)

144

5.5.1 Barriers to a cultural change needed for KM to succeed

Cultural change required for KM to succeed is often thwarted by several barriers, including lack of common language, lack of adsorptive capacity, and lack of time. In this study, sustainability executives were asked to give their opinions on what they felt to be the barriers to a cultural change needed for KM to succeed in their organization.

Of the firms interviewed, 10 firms expressed that the lack of time and meeting places constitute a major barrier to a cultural change needed for KM to succeed. According to Dalkir (2011), cultural change is thwarted by the lack of attention to some basic requirements, such as providing staff members with knowledge sharing meeting places, and legitimate time to spend in such meeting places. It is recommended that managers should encourage employees to take advantage of knowledge sharing meeting places so that employees can exchange ideas with one another. KM activities should be integrated with the daily work of staff members. It should not be done in the employees' spare time, which would convey KM activities as peripheral, secondary or "hobby-type" activities in comparison to "real work" (Dalkir, 2011).

Other barriers to a cultural change needed for KM to succeed as expressed by the sustainability executives include a lack of common languages (4 firms expressed this), intolerance for mistakes (4 firms expressed this), lack of absorptive capacity (4 firms expressed this) and rewarding of knowledge hoarding (4 firms expressed this).

The rewarding of knowledge hoarding was another barrier to the cultural change that's needed for effective KM implementation (4 firms expressed this).In many organizations, recognition, performance appraisals and promotions are all linked to what has been accomplished by being the first and only one with new idea, product or process (Dalkir, 2011). If employees hoard knowledge for the sake of rewards, then cultural change will not occur (Dalkir, 2011). In order to bring about the cultural change needed for effective KM implementation, it is recommended

that managers try to integrate knowledge sharing behaviors in performance evaluation criteria (Dalkir, 2011). Management should additionally reward good teamwork, collaboration and knowledge reuse whenever possible (Dalkir, 2011).

Of the firms interviewed, 4 firms expressed that a lack of absorptive capacity was also a barrier to the cultural change needed for KM implementation. An absorptive capacity refers to "the individual and/or organizational openness to change and innovation and the capability or preparedness for being able to integrate it" (Dalkir, 2011, pg. 260). If an organization has a low absorptive capacity, it may be difficult for that organization to carry out any cultural changes (Dalkir, 2011). One possible solution that a firm could employ is to augment its employee base by recruiting individuals who are selected for their eagerness to learn, their openness to new ideas, and their innovativeness in approach (Dalkir, 2011). Another solution is to provide existing employees with awareness seminars, creativity building workshops such as "thinking out of the box approaches," and other training opportunities in order to give them an opportunity to reframe their perception of themselves and of the planned cultural changes to the firm (Dalkir, 2011).

Change in any organization can be hindered if any employee's motive to request help from other employees is perceived as undesirable behavior by others, or as a manifestation of weakness (Dalkir, 2011). If employees are expected to know all the answers at all times, and by asking for assistance, this may portray that a staff member is not qualified for the job, then no one will ask any questions In this study, 4 sustainability executives expressed that intolerance for mistakes, and need for help and trust is a contributing barrier to a cultural change. Such firms should be able to have a reward system that actively promotes, supports and values interactions for help and knowledge sharing (Dalkir, 2011). Additionally, management should be able to ensure its employees that there will be no loss of status for not knowing everything. Concurrently, employees who provide knowledge and assistance should be rewarded (Dalkir, 2011).

Another barrier to the cultural change needed for KM to succeed lies in the lack of a common language amongst staff members. In this study, 4 sustainability executives expressed that point. Lack of a common language, refers to shared technical or professional languages (e.g. environmental scientist speak vs. manager speak) that can cause a lot of confusion in the workplace (Dalkir, 2011). This kind of cultural barrier change can be overcome by establishing a knowledge taxonomy, and knowledge dictionary for knowledge content, standard formats, translators, metadata, and knowledge support staff (Dalkir, 2011).

Gofee and Jones (2000) use two dimensions to create the four district organizational cultures (See table 9). The first dimension sociability is a measure of friendliness in the organization, e.g. the degree to which people might send birthday cards etc. Solidarity, the second dimension describes the degree to which people need to work together (despite personal disputes or conflicts) in order to get the job done. A high solidarity means that people can work together to achieve a common even when they may have personal disputes or conflicts .By being able to understand the culture of an organization, many managers, e.g. manager in the sustainability departments of mining firms can be able to recruit the most suitable personality types to work for them. In addition, by underrating the varying cultures involved in an organization this can help managers to ensure that different units (e.g. sustainability unit, business unit, exploration unit) comprising of various cultures can work together effectively.

5.6 Knowledge management tools and technologies

This study examined whether there were any technologies to support the management of sustainability knowledge. Of the firms interviewed 3 expressed that some limited technology infrastructure exists, such as search engines and emails, but nothing for effective collaboration, networking or sharing. Similarly, 3 of the firms expressed that that the technology infrastructure largely supports KM, but some barriers still exist for effective networking, publishing and finding published knowledge or knowledgeable people. Of the firms interviewed 15% stated that there exist various technologies for all employees to capture, share, and apply knowledge. Only

one firm expressed that there is no technology available for creating, sharing and applying knowledge. It is therefore recommended that;

a. Managers should ensure that there exist a wide variety of technologies to capture, share and apply knowledge.

b. There exists a wide range of diverse KM technologies that can be used to support knowledge sharing and dissemination (See table 10). Sustainability departments in mining firms need to understand that the underlying theme of KM technologies is that of a toolkit. Several technologies and tools for sharing, capturing and applying knowledge are borrowed from other disciplines and other are specific to KM (Dalkir, 2011). It is imperative for all technologies and tools to be mixed and matched in the appropriate manner in order to address the KM needs of the firm (Dalkir, 2011). The choice of the tools to use in KM toolkit should be consistent with the overall business strategy for the firm (Dalkir, 2011).

5.7 Knowledge management roles

From the findings, it is evident that KM roles are lacking in 8 firms that participated in the study. Establishing KM roles within the sustainability department is important for the successful implementation of KM. KM roles need to be established in order to ensure that the firm's KM goals are in line with the strategies and objectives of the firm, and that the firm acts like a learning organization, improving over time with the help of best practices and lessons learned.

a) Competency framework as developed by the TFPL could be used as a tool for mining firms to asses recruitment needs and also develop job descriptions for knowledge roles in the sustainability department or in sustainability projects (See appendix 5)

5.8 Knowledge management metrics

Most of the firms interviewed (10 firms) expressed that monitoring of knowledge is not done. It is therefore recommended that a combination of different metrics be utilized in order to fully assess the entirety of a KM program in an organization. Different metrics that can be used

148

include the balance scorecard method, benchmarking, the house of quality matrix, and result based matric just to name a few.

     5.9 Implementation through pilot projects

It is recommended to run a KM Pilot project in the sustainability department to demonstrate how the recommendations will positively impact organizational performance. Then through growth and expansion embed KM throughout the sustainability department or organization.

CHAPTER 6: CONCLUSION

There is little doubt that we have transitioned into a knowledge economy where what an organization knows is becoming more significant than the traditional sources of economic power such as land, capital and labor. Knowledge management practices and corporate applications of such practices are rapidly growing especially in the mining industry. Driven by innovation, speed to market, and quality improvements, mining companies are starting to harness the intellectual assets of its workers. This effort to harness the "knowledge-creating capability" of a business is one of the key elements of the information revolution that is changing the competitive landscape of businesses. Mining firms are forced to innovate and develop new techniques for improving the quality and functionality of products and reduce costs in order to survive in the market. .

In parallel the notion of sustainability is redefining the competitive landscape of businesses. Mining companies are starting to find new sources of competitive advantage, innovation, and business value, all by integrating sustainability considerations into business processes, strategies, and products. Most mining companies undertake a variety of activities that are aimed at sustainability. These activities include, protection of the natural environment, economic viability, worker health and safety and community development and stakeholder engagement. Transforming the mining industry as a whole in pursuit achieving the sustainability activities mentioned above both requires and generates a tremendous increase in individual and organization knowledge. Knowledge management (KM) can be applied to add value to that stock of sustainability knowledge.

It is not surprising that the adoption of KM has constituted substantially to many mining companies' success in dealing with the massive environmental challenges and technical challenges of frontier exploration and performance—e.g throughout the rapid advance of technology, an extension of offshore drilling, and a focus on environmental issues, KM initiatives have played a part in making operations more efficient and effective (Ramanigopal,

2012). When mining companies have been faced with new technology, outsourcing, new partnerships, and government regulation, their KM teams have played a role in providing support through technology and knowledge transfer, as well as asset management (Ramanigopal, 2012). When business issues involved capacity management, cost reduction, and the environment, KM can play a part through forecasting/scheduling and process and technique innovation (Ramanigopal, 2012).

At the same time, the design and implementation of KM tools and systems especially in the context of managing sustainability knowledge   in the mining industry has been difficult in some areas. This study affirms this.

Most striking has been the difficulties of effectively sharing knowledge as a result of different languages. The mining industry must contend with the difficulties and challenges of maintaining a geographically dispersed workforce, operations, and functioning according to clearly defined operational procedures. By having a geographically dispersed workforce, issues associated with different languages start to arise (2 firms expressed this concern) and this can serve as a key obstacle to knowledge sharing.

Another difficulty revealed in this study is the effective retention of project knowledge. Knowledge is a significant resource absolutely essential for any on-going project in an organization (Srikantaiah et al., 2010). What separates the mining industry from other industries is that most of the field work is normally in the form of projects therefore the ability to manage knowledge in such projects is imperative not only to the success of the project itself, but also to the creation of best practices and lessons learned which would ensure organizational continuity and sustainability. In this study close to half of the mining firms interviewed (7 firms) indicated that they usually didn't have regular "project close out meetings" as soon as a project is completed to review what happened, or what the team or the firm can learn from what happened (Figure 26). Similarly, 7 firms (nearly half) indicated that they don't usually document "lessons

learned "on projects as a means of passing along the things that worked or did not work on a project. Of the mining firms interviewed 6 firms indicated that they seldom capture sustainability knowledge from one project to another and that employees didn't always learn about what made one project successful and another unsuccessful .One firm expressed that they never have project close out meetings, and nor do they usually document "lessons learned " as a means of passing along the things that worked or didn't work on a project This calls for the implementation of KM at various stages of the project life cycle (initiation, planning, execution, and closure). KM situated in the context of a project carries several benefits, one of them being that a project on its own is an effective community of practice with better familiarity and relationships amongst groups of people. Additionally, in projects (in comparison to KM in organizations) it is much easier to measure KM parameters and to correlate them with cost, quality, and productivity measures (Srikantaiah et al., 2010).

The inability to prevent the loss of knowledge due to human resource attrition was a major issue of concern in this study. Departing employees carry with them key knowledge that is often important to a firm's capabilities and a key source of best practices. Of the mining firms interviewed, 7 firms relayed that they "always"and "usually" prevent the loss of sustainability knowledge due to human resource attrition" but the majority did not (Figure 27). The inability to prevent   knowledge loss as a result of human resource attrition is a major issue of concern for the mining industry. This is concerning as in the mining industry, baby boomers are starting to retire. Years of cumulative knowledge and experience will be lost to the mining industry as a result of technical staff born in the baby boomers era retiring. As a result, a number of inter-organizational and industry wide knowledge sharing networks have been established (e.g. the Global Benchmarking Group which is a made up of representatives from the world's largest oil companies, APQC KM conferences and the Energy Knowledge Management Network) (Grant, 2013)

An area of industry weakness lies in the lack of existence of KM roles in the sustainability departments of the mining firms surveyed. From our findings the majority of firms (8) expressed that there are no KM roles in the sustainability department. Of the mining firms interviewed, 4 firms expressed that some KM roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, knowledge brokers). KM roles need to be established in order to ensure that mining firms KM goals are in line with the strategies and objectives of the firm, and that the firm acts like a learning organization, improving over time with the help of best practices and lessons learned.

When it came to the use of tools and technologies to support the management of sustainability knowledge, 5 firms had a general infrastructure of supportive technologies. Without the proper technologies, this can have an effect on how knowledge is captured, shared and applied across the organization.

In aligning knowledge management to a company's business strategy, this study pointed to a key question "is knowledge management fully fixed into the business strategy?". From the findings 2 firms indicated that knowledge management is fully fixed into the business strategy. Of the firms interviewed, 4 firms indicated that knowledge management is not fully fixed into the business strategy of the firm. According to Trevor et al (2010), most firms do not attain the required performance levels even when programs are in place for managing knowledge resources mainly because knowledge programs are not linked to the firm's business strategy.

A further area of industry weakness was present in evaluating how well KM is succeeding (milestone and formative evaluation) and how well KM has helped an organization attain organizational goals (outcomes and summative evaluation). Of the firms interviewed, 10 firms expressed that monitoring of knowledge is not done. In practice very few organizations have the luxury of allocating resources to implement something without being required to know its value i.e. the cost associated with KM are easy and visible to measure, however the benefits tend to be

intangible, opaque and much more long term in nature (Dalkir, 2011, NHS, 2005). This makes the return on investment (ROI) of knowledge management more difficult to assess (Dalkir, 2011). However, it has to be made clear that without measurable success, the enthusiasm and support for KM may cease to exist. Additionally, without measurable success, it will be hard for companies to manage performance proactively.

To conclude, the fact remains that the difficulties associated with managing sustainability knowledge in the mining industry (as shown in this study) can be overcome by effective implementation of knowledge management. Sustainability executives in the mining industry should recognize the benefits of investing in KM from a standpoint where KM can be used to drive learning and improvement, prevent employees from constantly re-inventing the wheel, provide a baseline for progress measurement, reduce the risk associated with human resource attrition, and make visual thinking (tacit knowledge) tangible and easy to disseminate. Effective implementation of knowledge management will need to be governed by top management commitment and the ability of the organization to make changes in strategic programs and adopting the necessary behaviors that facilitate KM. Sustainability executives should also understand that a number of critical challenges in terms of budget, time and human resources must be effectively addressed so as to obtain the maximum benefit of knowledge management investment.

6.1 Research Limitations

One of the limitations that existed in this study was the incapacity to not fully explore the understanding and perception of what the definition of KM meant to each firm interviewed. An operational definition of knowledge management as defined by Dalkir (2011) was presented to all the sustainability executives in order to ensure uniformity. Sustainability executives were asked to contextualize their responses based on that definition. However it has to be understood that knowledge is subjective in nature and also value laden in interpretation. More research weight could have been added to this study if each firm was individually asked what "knowledge" meant to them and framed our KM questions from that definition.

Another limitation to this research was that the views regarding the management of sustainability knowledge were gathered from senior sustainability executives at the corporate level. These sustainability executives may have given their own perception of how sustainability knowledge is managed, and this may not represent the entire organizations views. However it has to be noted that the sustainability executives had a solid foundation in KM and seem to know the detail to how their organization functions and manages knowledge. The data in this study could however have been richer if operational staff members were interviewed (e.g. Environmental Managers and Environmental Scientist on the ground). However, due to constraints in time and resources, this was not possible and the only feasible option was to interview sustainability executives at the corporate level.

From figure 12, it is evident that the transition from knowledge capture/ creation to knowledge sharing and dissemination consist of a feedback where knowledge is assessed (Dalkir, 2011). Knowledge is then made contextual in order to be acquired and applied. This stage then feeds back into the knowledge capture /creation stage in order to update the knowledge. In this thesis, such feedback mechanisms were not fully explored. Doing so would have yielded comprehensive findings to how sustainability knowledge is managed through an integrated knowledge management cycle.

155

Bias in subjects was a limitation to this study. There exists some possibility that some questions may not be answered correctly due to the tendency of a sustainability executive to "give desirable answers" in order to preserve the integrity and image of one's firm. Additionally, unintentional human error in communication between interviewer and interviewee may have happened.

Lastly, limitations that existed in this study arouse as a result of the semi – structured methodology used. Analysis in this study was time consuming and the depth of qualitative information was difficult to analyze (for example deciding what is and what is not relevant). The findings were rather difficult to generalize in this study. Lastly, it was difficult to know whether the respondent was giving accurate information. The respondent may not consciously give inaccurate information, but may have imperfect recall.

6.2 Future works

From the findings of this research, it was evident that there was some uniformity in some KM practices in all firms. Such uniformity could pave the way for the standardization of KM. Future research on a proposal for a KM standard to be submitted to an international standard setting body such as the *International Organization for Standardization* (ISO) should be tackled. This KM standard would set down requirements for knowledge management solutions (capturing, sharing and applying knowledge) and KM foundations (KM, metrics, KM, culture, KM tools, KM team, KM Strategy). The standard would make it easier for the sustainability departments of mining firms to easily implement and monitor KM in the daily fabric of their operations. This standard, could also be used to manage sustainability knowledge or knowledge in general in a variety of businesses of any size and in any field.

Further detailed research into any one of the difficulties and failures in the implementation of

KM revealed in this study would provide greater insights to better manage sustainability knowledge in the mining industry.

Some mining firms interviewed in this study perceived the meaning of "knowledge" differently from other firms. Due to the subjectivity of a definition of "knowledge", perhaps future research exploring the use of a concept of analysis technique could be employed to obtain a consensus on key attributes of the definition of knowledge in the mining industry, using a list of illustrative examples and non-examples.

Future work on the cost benefit of employing KM in the sustainability department of mining firms should be tackled.

APPENDICES

Appendix 1: A timeline of sector sustainability initiatives (Lins & Horwitz, 2007).

1987 "Sustainable development" *Brundtland Report*

1992 UN "Earth Summit," Agenda 21. Creation of World Business Council for Sustainable Development (WBCSD)

Extractive Industries Review (EIR), founded and managed by the World Bank

International Council of Mining and Metals (ICMM) formed

Global Reporting initiative (GRI) Mining and Mineral sector Supplement published

Council for responsible Jewellery Practices

UN Global Compact

Breaking New Ground published by MMSD

1996   1997   1998   1999   2000   2001   2002   2003   2004   2005   2006

Global Mining Initiative (GMI) initiated by CEO's of nine major mining companies

Mining, Minerals and Sustainable Development (MMSD) Project undertaken by WBCSD

GRI publishes G3 Guidelines for Sustainability reporting

Resources Endowment Initiative

First Conference of the Extractive industries Transparency initiative (EITI)

1994 Berlin Guidelines

CATEGORY OF COMMUNITY DEVELOPMENT TOOL	TOOL NAME AND NUMBER	WHEN TO USE THEM					WHO MIGHT USE THEM			
		Exploration	Feasibility	Construction	Operations	Decommissioning, closure and post closure	Government	Community	NGO	Company
ASSESSMENT	1 Stakeholder Identification	Start	Ongoing	Ongoing	Ongoing	Ongoing	Primary	Primary	Primary	Primary
	2 Social Baseline Study		Ongoing		Repeated	Repeated	Primary		Primary	Primary
	3 Social Impact and Opportunities Assessment		Start	Start	Repeated	Repeated	Primary	Support	Support	Primary
	4 Competencies Assessment			Ongoing	Ongoing		Primary	Primary	Primary	Primary
PLANNING	5 Strategic Planning Framework				Ongoing	Ongoing	Primary	Primary	Primary	Primary
	6 Community Mapping				Start		Primary	Primary	Primary	Primary
	7 Institutional Analysis				Start		Primary	Primary	Primary	Primary
	8 Problem Census				Start		Support	Primary	Primary	Support
	9 Opportunity Ranking						Primary	Primary	Support	Primary
RELATIONSHIPS	10 Stakeholder Analysis		Start	Ongoing	Ongoing	Ongoing	Primary	Primary	Primary	Primary
	11 Consultation Matrix	Start	Repeated	Ongoing	Ongoing	Ongoing	Primary	Primary	Primary	Primary
	12 Partnership Assessment		Start	Ongoing	Ongoing	Ongoing		Primary	Primary	Primary
PROGRAM MANAGEMENT	13 Conflict Management		Start	Ongoing	Ongoing	Ongoing	Support	Primary	Support	Primary
	14 Community Action Plans			Start	Ongoing	Ongoing	Support	Primary	Primary	Primary
MONITORING & EVALUATION	15 Logical Framework			Start	Ongoing	Ongoing	Primary	Primary	Primary	Primary
	16 Indicator Development			Start	Ongoing	Ongoing	Primary	Primary	Support	Primary
	17 Goal Attainment Scaling			Start	Ongoing	Ongoing	Primary	Primary	Primary	Primary

This matrix provides a general guide to the tools including who might use them and when during the project cycle.

KEY: Start activity   Ongoing   Repeated   Primary user   Support user

Appendix 3: Knowledge Flows in sustainable oriented FV's (Wu and Haasis, 2011).
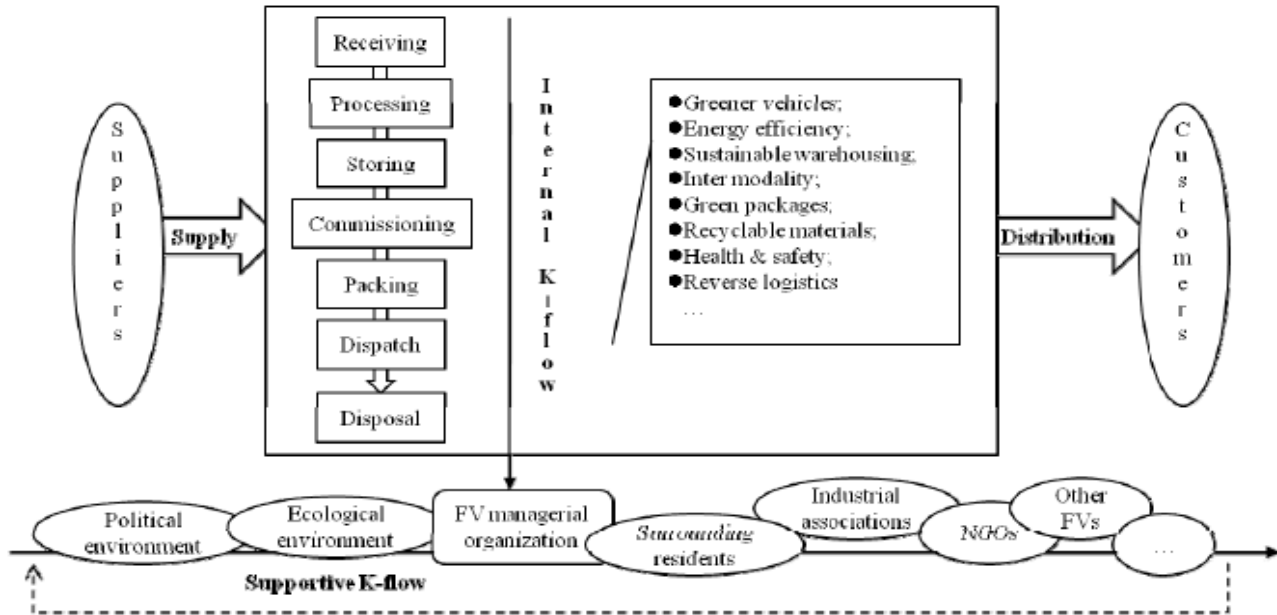
The Meyer and Zack KM Cycle
Meyer, M., and M.Zack. (1996). The design and implementation of information products. *Sloan management review*, 37(3): 43-59

- Derived from work on the design and development of information products.
- Information is 'sold' to customers (databases, news feeds, and customer profiles)
- Refinement and renewal are crucial (via feedback) in order to avoid obsolescence
- Meyer sand Zack analyzed the major development stages of a knowledge repository consisting of acquisition, refinement, storage retrieval, distribution and presentation.
- Acquisition of data   addresses the issues regarding the sources of material such as scope, breadth, depth credibility, accuracy, relevance etc. Source data must be of the highest quality otherwise the intellectual products produced downstream will be inferior.
- Refinement refers to cleaning up (e.g. sanitizing content so as to ensure complete anonymity of sources and key players involved) or standardizing (e.g. conforming to templates of best practise or lessons learned as within that particular organization)
- Storage may be physical (file folders, printed information) or digital (database, Knowledge management software)
- Distribution describes how the product is delivered to the end user
- The effectiveness of each of the preceding value added steps is evaluated in the presentation stage. It is here that the user should have sufficient context to be able to make us of this context or otherwise the KM cycle has failed to deliver value.
- The Meyer and Zack model is one of the complete descriptions of the key elements involved in knowledge management model. Its strengths derives primarily form its comprehensive information- processing paradigm that is completely adaptable to knowledge based content.
- The idea of refinement is an important stage in KM cycle that is ignored.

Product Platform

Respiratory
Content
Structure

Sources

Product Family

Content
Packaging
format
Access
distribution
Interactivity

Users

| Acquisition | Refinement | Store Retrieval | Distribution | Presentation |

High level view of the Zack information

Respiratory
Content
Structure

Sources

Reports
Newsletters
Bulletins

Users

Refine

| Acquire | Analyze, interpret, report | Store | Distribute | Present |

| Calls and Surveys | Edit and Format |

| Decompose into K units, index and link | Indexed and linked knowledge units | Online via Web and groupware | Interactive selection of Knowledge Units |
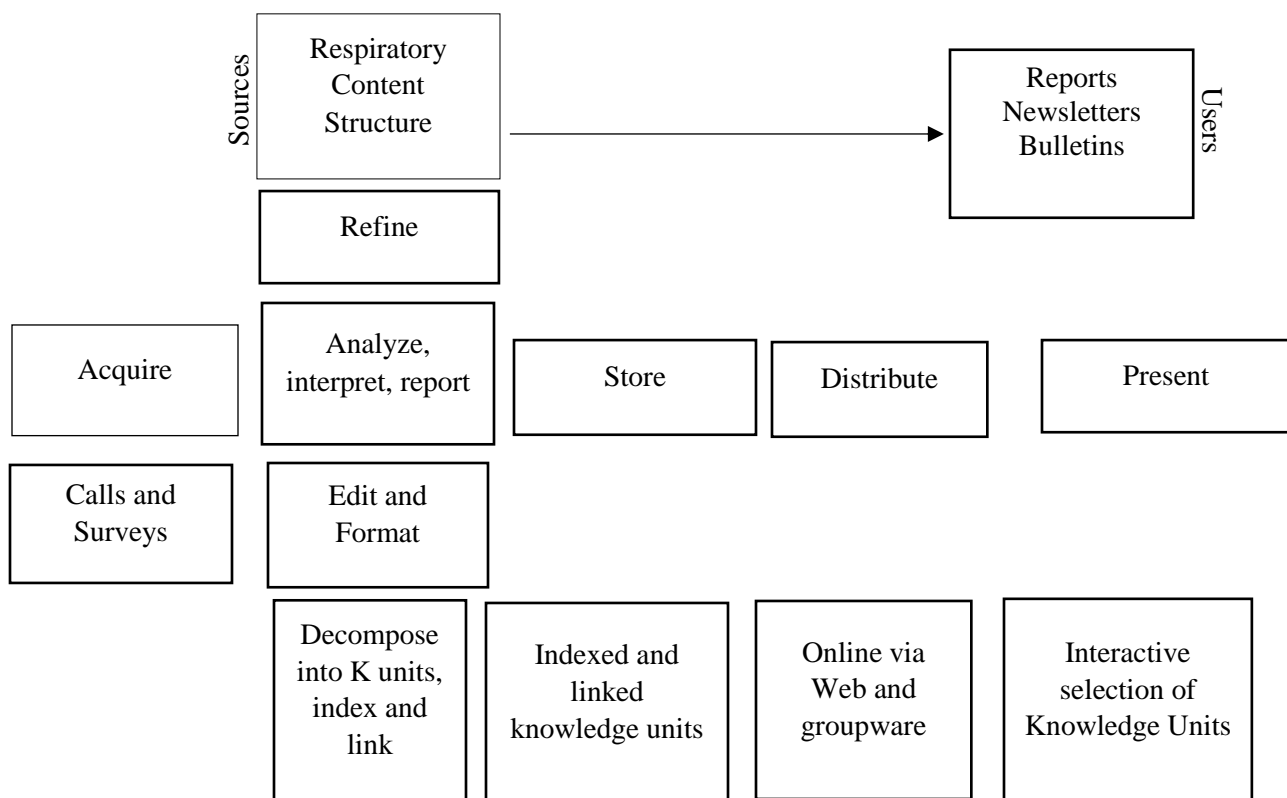
Detailed view of the Meyer and Zack information cycle

- Get, use, learn and contribute phrases are tactical in nature and are triggered by market driven opportunities or demands and typically result in day to day use of knowledge to respond to these demands.
- Assess, build/sustain and divest are strategic in nature triggered by shifts in the macro environment
- The first stage "get "consists of seeking out information needed in order to make decisions, solve problems, or innovate.
    - User needs must be well understood in order to match information seekers with the best possible content
    - This involves knowing where knowledge resources exist and can be assessed.
- The "use" stage deals with how to combine information
    - In new and interesting ways to foster organizational innovation
    - The focus is on individuals then on groups.
- The "learn" stage refers to formal process of learning from experiences as a means of competitive advantage.
    - Organizational memory is created so that organizational meaning becomes possible from success (best practises) and failures (lessons learned).
    - Learning in organization is significant as it represent the transition step between the application of ideas and the generation of new ones.

- The "contribute" stage deals with getting employees to post what they have learnt to the knowledge   base (respiratory)
    - Making knowledge visible and available.
    - Sharing
- The "assess" stage deals more with the group and organizational level.
    - Assessment refers to the evaluation of intellectual capital.
    - This requires the organization to define mission critical knowledge and map current intellectual capital against future knowledge needs.
    - The organisation must also develop metrics to demonstrate that it is growing its knowledge base and profiting from the investment in intellectual capital.

- The "build/sustain" stage ensures that future intellectual capital of the organization will keep the organization viable and competitive.
    - Resources must be allocated to the growth and maintenance of Knowledge. They should also be channelled in a way that creates knew knowledge and reinforces existing knowledge.

-In the "divest" step, the organization should not hold on to assets, physical or intellectual if they do not create value for the organization.

- Organizations need to examine the resources required to maintain the intellectual capital or use those resources elsewhere else where they would be better spent.
- Redeploying, outsourcing or terminating

-The Bukowitz and Williams KM Cycle introduces two critical phases; the learning of knowledge content and the decision as to whether to maintain this knowledge or divest the organization of this knowledge content.
-It is more comprehensive than the Meyer and Zack cycle as the idea of tacit and explicit knowledge is incorporated.
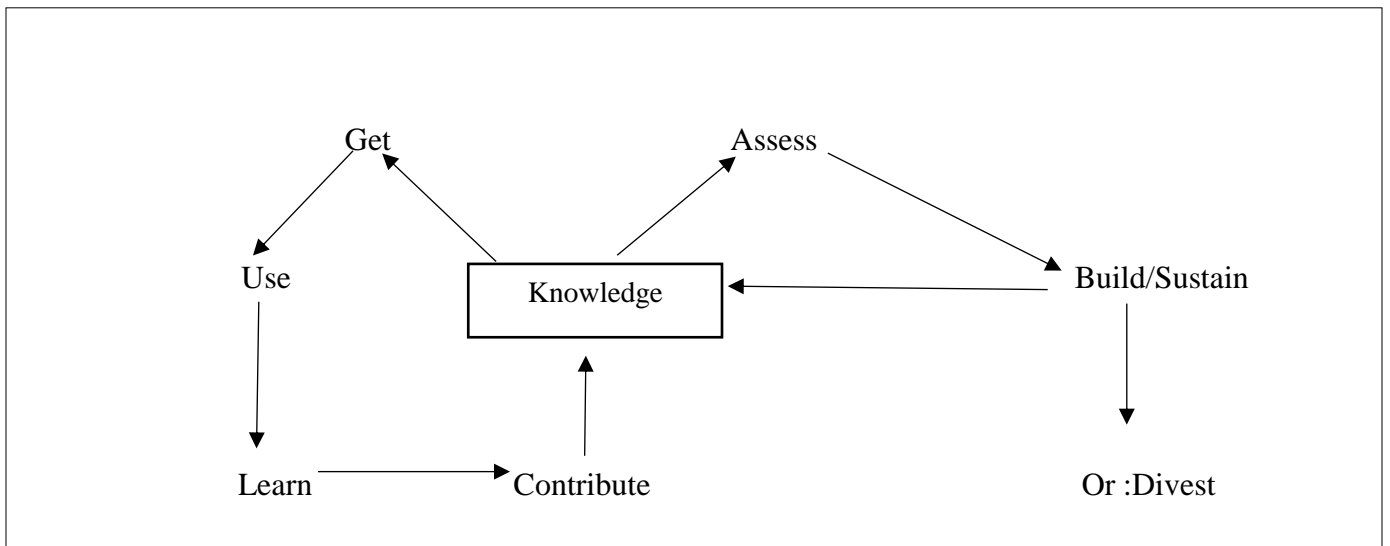
Processes in the Bukowitz and Williams KM Cycle

The McElroy KM Cycle

McElroy, M. (1999). The Knowledge Life Cycle. *ICM Conference in KM,* Miami FL.

-Knowledge Integration: broadcast, search, teach, share
> -In Knowledge integration an organization introduces new knowledge claims to its operating environment and retires old knowledge claims.

-One of the great strengths of the McElroy KM Cycle is how knowledge is evaluated and how a conscious decision is made as to whether or not it will be included in the organizational memory.
- The KM cycle focuses on processes to identify knowledge content that is of value to the organization and its employees.

Beliefs and Claims	→	Organizational Knowledge	→	Knowledge Integration

Double loop learning ↑   Beliefs and Claims ↓

Business processing environment	← Single loop learning → *Beliefs and Claims*	Distributed organizational knowledge base
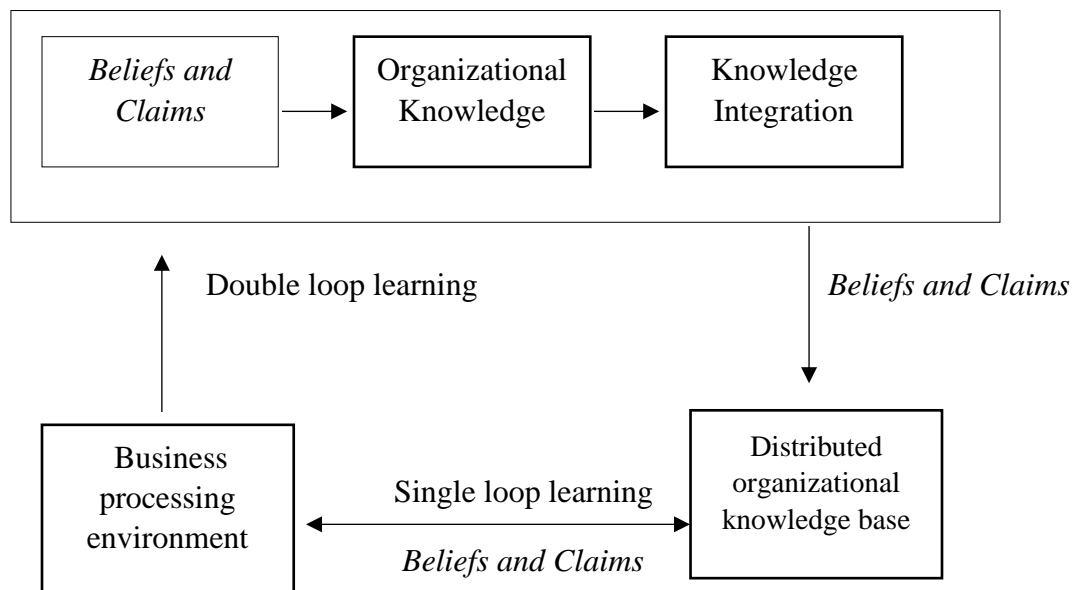
High Level processes McElroy KM cycle
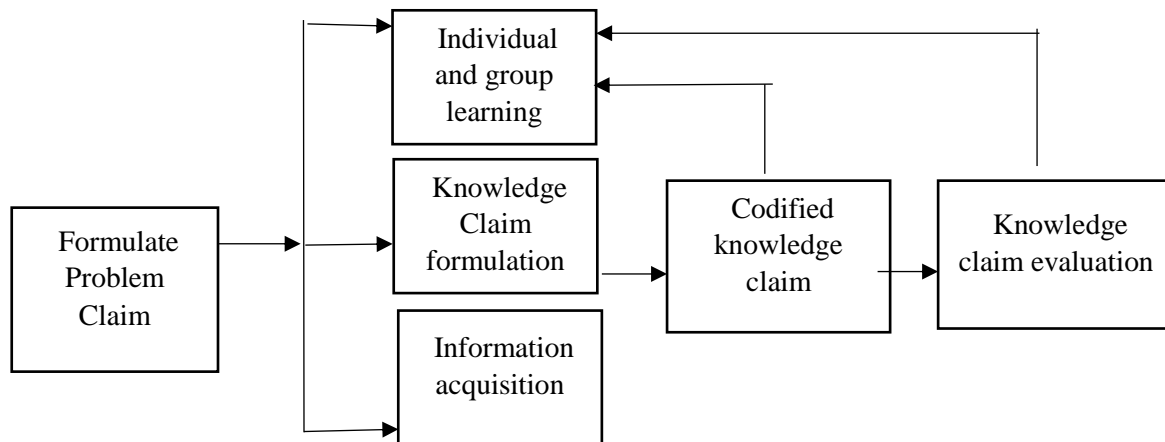
Knowledge production process in the McElroy KM Cycle

The Wiig KM Cycle

Wiig.K. (1993). Knowledge Management Foundation, Arlington Texas: Schema Press
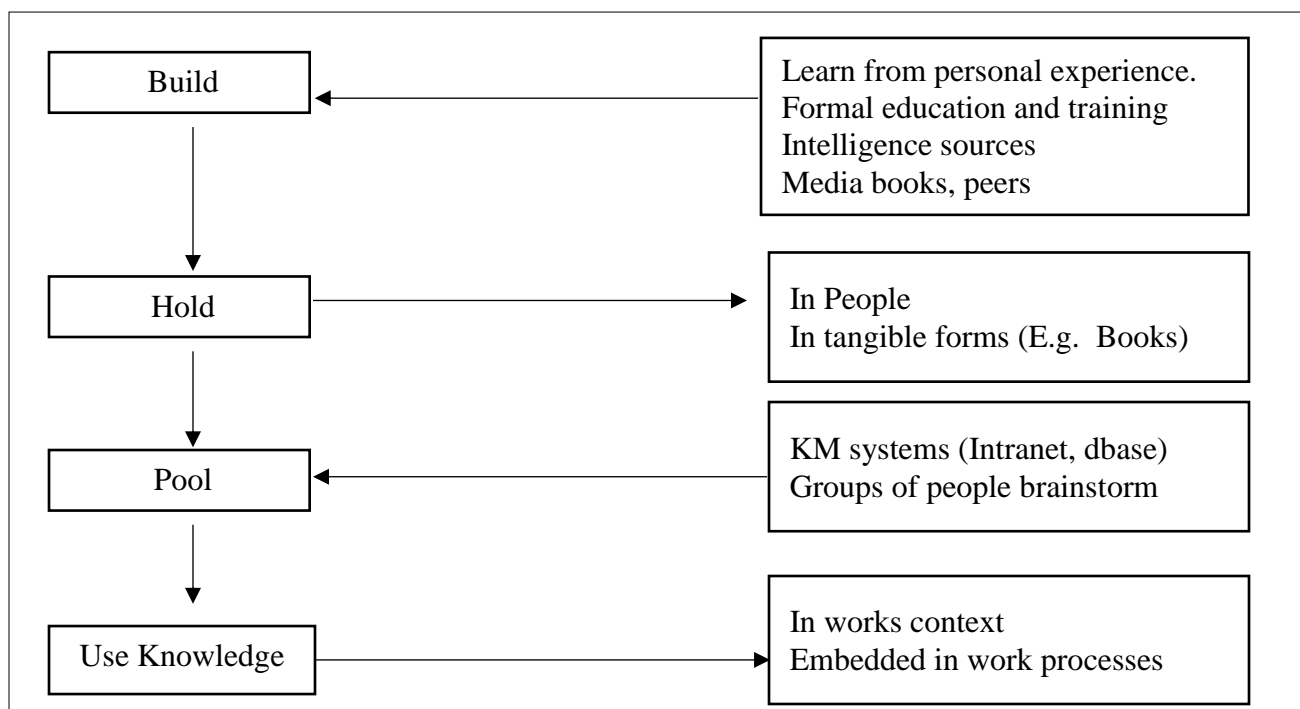
Processes of the Wiig KM cycle

- In order for organizations to conduct its business successfully, it must have
  a) Business and customers (products and services)
  b) Resources (people, capital and facilities) and the ability to act
- Knowledge is is the principal force that determines and drives the ability to act intelligently.
- The Wiig KM cycle is comprised of 4 steps
- An advantage of the wig cycle is the detailed description of organizational memory to generate value for individuals, groups and the organization itself. Wiig also emphasizes the business use of knowledge and constraints that may prevent knowledge from being fully used, opportunities and alternatives to managing that knowledge and the expected added value to the organization

Build	**Hold**	**Pool**	**Apply**
-obtain	-remember	-coordinate	-perform tasks
-analyze	-accumulate in repositories	-assemble	-survey
-synthesize	-embed in repositories	-reconstruct	-select
-codify	-archive	-synthesize	-observe
-model		-access	-synthesize
-organize		-retrieve	-evaluate
			-decide
			-implement
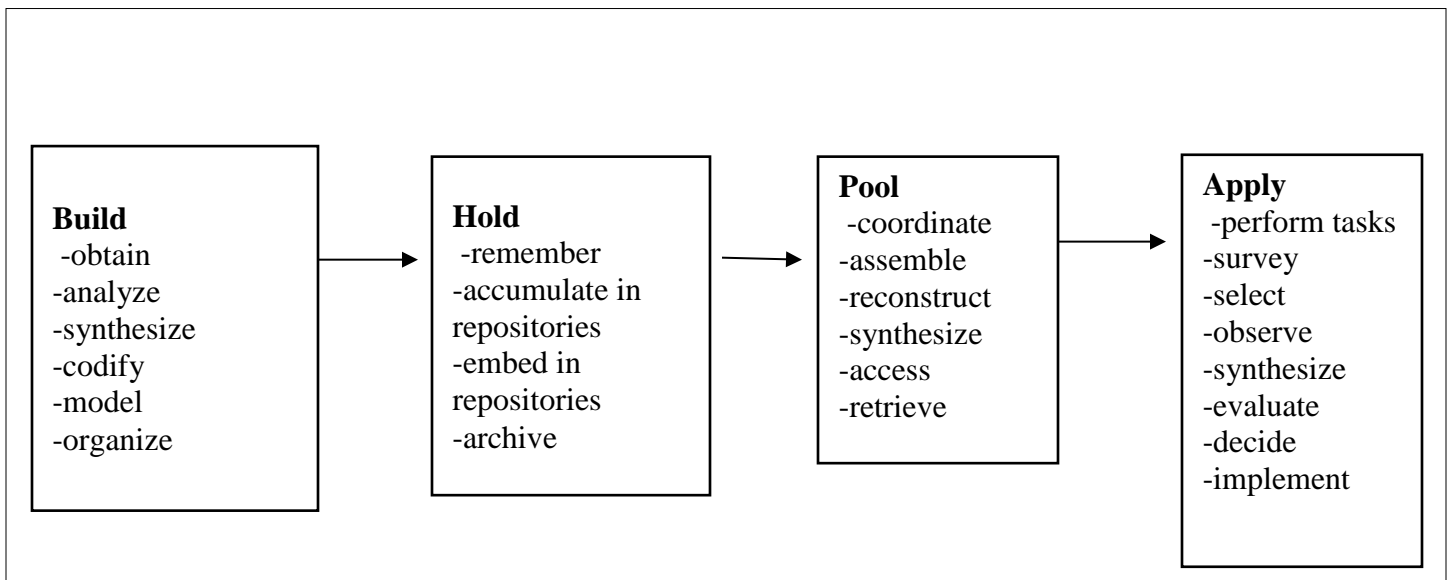
Summary of the steps of the Wiig KM cycle.

Appendix 5- Excerpt from the TPFL KM skills map (TFPL, 2000)

Skills sets: knowledge management awareness includes:
- An understanding of the KM concept - the philosophy and theory - and an awareness of the experience of other organisations in developing KM solutions and approaches.
- An understanding of, and the ability to, identify the business value of KM activities to the organisation
- An appreciation of the range of activities, initiatives and labels which are employed to create an environment in which knowledge is effectively created, shared and used to increase competitive advantage and customer satisfaction.

Strategic and business	*Management*	*Intellectual and learning skills*	*Communication and interpersonal*	*Information management*
Business awareness/experience	Administration	Ability to deal with ambiguity		Abstracting
Business processes	Business processes	Analytical	Client / customer service	Analysis
Business planning	Change management	Bigger picture view	Coaching	Archives management
Change management	Co-ordination	Conceptual thinking	Communication	Bibliometrics
Entrepreneurial	Cost control	Emotional intelligence	▪ oral and written	Cataloguing
Forward thinking	Financial management	(Self-awareness, self	Community building	Codification
Globalization issues	Leadership	motivation, persistence,	Consulting	Content management
Industry/ sector knowledge	Measurement	read emotion in others,	Counselling	Document management
Leadership	▪ performance	rein in emotions, zeal)	Diplomacy	Editing / writing
Organizational design	▪ impact	Innovation	Facilitation	External sources
Organizational skills	▪ value	Lateral thinking	Influencing	Indexing
Prioritization	People management	Learning techniques	Listening	Informatics
Process understanding	Process mapping	Mentoring	▪ ability, willingness	Information architecture
Risk management	Project management	Organizational skills	and self	Information auditing / mapping
Strategic thinking	Persuasion	Original thinking	▪ discipline to listen	Information design
	Prioritization	Perspective	Marketing	Information / document life cycle
	Quality assurance			

169

Strategic planning	Relationship management	Problem solving	Mentoring	Information processes
Understanding value chain	Team building	Positive thinking	Negotiation	Informatics
Visioning	Time management	Personal accountability	Networking	Information analysis tools
	Training and development	Self-motivation	Partnering	Intranet / extranet management
	skills mapping		Political	IT applications
	needs analysis		Presentation	Metadata
			Team working	*IT*
			Training	Database design
				Database management
				Data warehousing
				Distributed publishing
				E-business minded
				Hardware
				Information architecture
				Internal & external sources
				Integration
				Intranet / extranet design
				Programming
				Software applications
				Workflow

On the following pages are questions about KM policies and practices to be asked in a semi structured interview.

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

a) Yes   b) No

Comments:

A1.Identifies whether the mining firms in question have heard of the term Knowledge management as a business concept. Reference: Smith et al (2010)

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector-specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)

c) Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d) Other:
e) Don't Know

Comments:

B1. Seeks to understand the major approaches to tacit knowledge acquisition at the individual or group level. Reference: Parsaye (1998)

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?
a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments:

B2. Explores the explicit knowledge codification within the sustainability department, i.e. Converting tacit knowledge into explicit usable forms. The purpose of rendering tacit knowledge to an explicit form is to make institutional knowledge visible, usable and accessible for decision-making. References: Dalkir (2011)

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments:

B3. Stresses on the significance of record keeping during knowledge capture, especially tacit knowledge capture. According to Brown et al (2013) codification and storage of tacit knowledge into a Knowledge management System (KMS) can enable consistent access to the knowledge by

a large number of people and is deemed a fairly efficient approach when knowledge is relatively static. References: Brown et al (2013), Dalkir (2011)

B4. Who has access to the information recoded in question B3?

  a) All employees
  b) Employees working in the sustainability department
  c) Specific people in the sustainability department
  d) Don't Know

Comments:

B4 is a follow up question to question 3 that seeks to identify who has accesses to the organizational knowledge respiratory of the firm. The significance of this questions lies on the basis that if there is no well-constructed knowledge storing infrastructure within the firm, this can hinder knowledge sharing. References: Dalkir (2011)

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm						
B6. We capture knowledge by observing other firms demonstration of techniques or procedures						
B7.We capture Knowledge through experimental learning i.e. knowledge that is created by doing and practicing						

B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.					
B9.We prevent loss of knowledge from retiring operations employees and other turnover					
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.					
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.					
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.					

B13.How is the information from the capturing methods in Questions B5 to B8 held?

    a) Hard copies
    b) Electronic copies
    c) Central Electronic database (Company Intranet)
    d) No records held
    e) Don't Know
    f) Other:

Comments:

B5-B9 Explores the various types of tacit knowledge capture at the Organizational level (through - Grafting, Vicarious Learning, Experimental Learning, and Inferential Learning – double loop learning) that may occur within the sustainability department of the mining firms in question. B10 – 12 explores the capturing and retention of Project knowledge. Knowledge retention is a significant benefit for mining firms working in CSR projects   because it contributes to continue learning and avoidance of repeated mistakes. References: Nonaka and Takeuchi (1995) B13 seeks to understand if the four types of organizational knowledge capture is stored in a knowledge respiratory. References: Huber (1991), Inkpen and Beamish (1997), Dalkir (2011), Malhotra (2000), Mintzberg (1990).

B14. How does your firm pre-empt the risk of losing vital sustainability knowledge from departing employees

    a) Structured Interviews
    b) Knowledge Transfer Techniques
    c) Other:
    d) Don't Know

> Comments:

B14. Looks into ways that mining sustainability departments prevent operational gaps from departing staffs. Departing staff carry with them key Knowledge that is often important to a firm's capabilities and a key source of best practices. References: Dalkir (2011)

Section C: Knowledge Sharing and Learning

C1. Is sustainability knowledge shared across the sustainability department through networking at peer level?

    a) There is no sharing of knowledge through peer or social networks.
    b) Communities of practice (CoP) and knowledge-sharing networks are rare.
    c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
    d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
    e) Don't Know

> Comments:

C1: Explores if sustainability knowledge is shared across the sustainability department through networking at peer level. References: Brown et al (2013)

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges				
Conduct their own research				
Look into the firms database				
Access Hard copy files				
Google				
Read a manual				
Attend a training course				
Ask a community of practice				
Ask a social network				

Comments:

Other:

C2 Looks at the various ways in which employees gather knowledge when in need of knowledge. This is important as it helps employee's re- use knowledge and prevents them from constantly re-inventing the wheel.

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

a) Yes we do through Social network Analysis Charts
b) Yes we do through Organizational charts
c) Other
d) Don't Know

Comments:

C3. Seeks to explore how the sustainability departments of the firm visualize and understand the many relationships that can either facilitate or impede knowledge sharing and creation. References: Anklam (2003), Donath (2002)

C4. How frequently does your firm use the following techniques to share sustainability knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching					
Use quality circles to share sustainability knowledge					
Utilize brainstorming techniques					
Write case notes on successful and unsuccessful processes					
Lessons learned systems					
Communities of practice					
Workshops					
Email					
Peer assist					
Training					

Other:

C4. Looks at the various techniques that may be used within the sustainability of the mining firms to disseminate sustainability knowledge. References:
Bennett and Gabriel, H. (1999), Nonaka and Takeuchi (1995)

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

   a) Never
   b) Seldom
   c) Usually
   d) Always
   e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

   a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.

Comments:

   b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
   c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
   d) Other
   e) Don't know

Comments:

C5-6. Seeks to understand how good ideas through knowledge sharing lead to best practices (an improved way of doing things) and to what extent best practices and key knowledge are created, owned, shared and maintained within the sustainability department. References: Knoco (2013)

C7. How is sustainability knowledge transferred within your firm?

a) Verbally at team meetings
b) Written instructions
c) Ad- hoc verbally
d) Intranet
e) Video
f) Training
g) Mentoring
h) on the job training
i) Communities of practice
j) Don't know
k) Other:

Comments:

C7. Seeks to explore how sustainability knowledge transferred within the mining firms.
References: APQC (1999)

C8. How frequently does learning at the start of a new project occur?

a) Never occurs within the suitability department. All new Projects are based on what the relevant staff already knows
b) Is rare within the suitability department. Only a few projects will learn from others before they start.
c) Happens some of the time within the suitability department. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the suitability department. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) Happens some of the time within the suitability department. It is applied in certain tasks.
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

   a) Never occurs within the suitability department. The knowledge at the end of a project is never captured.
   b) Is rare within the suitability department
   c) Happens some of the time within the suitability department. It is applied in certain tasks.
   d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
   e) Don't Know

Comments:

C8-10 Explores if learning occurs at the start of a Project(Learning before) , During a Project, when project teams discuss their own learning (Learning During) and Learning after when project teams capture and document new knowledge to share with others. References: Collison and Parcell (2001), Milton (2005)

11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

   a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
   b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
   c) Organizational culture does not create a climate of trust
   d) conception that knowledge is property
   e) Don't know how to share
   f) Different Languages
   g) Don't know who to share with
   h) Don't know what to share
   i) Don't Know
   j) Other:

Comments:

C11. Explores the various barriers of Knowledge sharing within the sustainability departments of the miming firms. References: Dalkir (2011)

Section D : Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies
b) task support systems
c) personalization or profiling techniques
d) Don't Know
e) Other

```
Comments:
```

D.1 Seeks to explore knowledge acquisition in the sustainability department at the individual level. References: Bloom et al (1964), Gery(1991), Dalkir (2011)

D2. Does your firm have a system or tool to support?
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

```
Comments:
```

D2 Seeks to explore the presence or absence of Knowledge Management Systems (KMSs) within the sustainability departments of the mining firms in questions. Reference: Dalkir (2011)

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

```
Comments:
```

D.3 examines whether the sustainability department of the mining forms in question reuses knowledge as the re- use of knowledge is a good measure of how valuable information has been managed in organizational memory management systems. Knowledge reuse also prevents staff from constantly re- inventing the wheel. Reference: Dalkir (2011)

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements					
Operations staff has the information they need, when they need it					

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions						
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques						
Nobody challenge's the status quo						

182

Employees have to do things the official way, even if there is a better way of doing it					
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn					
Staff have complete freedom to learn from each other without management oversight					
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating					
Openness is valued in the organization					
People are willing to help each other and share information					
Employees feel as if a sense of belonging with the sustainability department is very weak.					

E 1. Explores whether the sustainability departments have a : mercenary culture that focuses on strict goals, communal culture that gives its members a sense of belonging , though it is also

task – driven, a networked culture where members are treated as family and friends and a fragmented culture where the sense of belonging to and identification with the organization is weak. References: Gofee and Jones (2000), Dalkir (2011), Knoco (2013)

E2. How is the nature of knowledge culture within the sustainability department of your firm?

   a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
   b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
   c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
   d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
   e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer					
Trust is prevalent in all interactions					
There is communication and co-ordination between groups					
Openness/Transparency - No hidden agendas					
Reward Structure: There is recognition for knowledge sharing with peers.					
Organizational culture encourages innovation and continuous improvement					

E2 and 3 .Seeks to understand the linkages between organizational culture and Knowledge sharing. Reference: Gruber and Duxbury (2000), Knoco(2013).

E4. If your firm does not have a Knowledge sharing culture, what do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) Lack of Time and meeting places
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation

d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

E.4. Explores the strategic implications of organizational culture. In particularly, it examines what cultural barriers exists that impede a firm's ability to undergo through a culture change needed for KM to succeed. References: Fullam (2001), Dalkri (2011), Kilmann et al (1986), Cohen and Levinthal (1990)

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

F1 Explores the presence or absence of KM roles within the sustainability department of the mining firms in question. References: Knoco (2013)

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainability knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people

e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

G1. Seeks to explore the absence or presence of any KM technologies within the sustainability department of the mining firms in question. References: Knoco (2013)

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
c) There are ongoing discussions within the firm to try and develop a knowledge management strategy

Comments:

d) Few people express that knowledge is significant to the firm.

H1. Explores the existence of a knowledge management strategy within the mining firms in question. References: Collison and Parcell (2001)

2. How closely is KM linked to the business strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) Some business areas or projects have defined critical Knowledge areas, which they manage
d) Knowledge management is fully fixed into the business processes. I.e. majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

H 2
Assess whether KM is linked to the business drivers and strategy of the firms. The importance of this question lies on the basis that most firms do not attain the required performance levels

(increased efficiency and leverage of knowledge assets for competitive advantage) even with practices in place for managing knowledge resources. Research by Smith. et al (2010) suggests that such shortcomings can be addressed by the linking of knowledge management to business strategy. References: Smith et al (2010).

Section I: Knowledge Management Metrics

1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

- a) Benchmarking against industry practises
- b) Balanced Score card method
- c) House of Quality method
- d) Result base management accountability framework (RMAF)
- e) Don't know
- f) Other

> Comments:

I1 Seeks to understand how the mining firms in question measure the success of their Knowledge management initiatives. References: Dalkir (2011), Kaplan and Norton (1992, 1993, 1996)

Ryerson University
350 Victoria Street
Toronto, Ontario
M5B 2K3
Main
Number :(416) 979 5000

"Managing sustainability knowledge in the Canadian mining industry"

This research study is being conducted by Waad Khogali Ali under the supervision of Dr. Philip Walsh P.Geo from the Environmental Applied Science and Management program at Ryerson University. The purpose of the study is to identify and discuss KM techniques that are used to manage sustainability knowledge in the Canadian Mining Industry. In particularly, this study will seek to;

1. Identify and discuss the existing practices of sustainability knowledge acquisition, sharing and application in the mining industry.
2. Identify and discuss organizational culture, KM strategy, KM matrices, KM technologies and the role played by senior management in promoting KM practices within their sustainability departments.
3. Set recommendations to better manage sustainability knowledge in the mining organizations explored.

You are being invited to participate in this research study by being involved in a semi-structured interview. Completion of the interview will take 45 minutes to 1 hour of your time.
The findings from this study may be beneficial to your firm as it will set forth recommendations on how better to manage sustainability knowledge, which may build benefits including a sustainable competitive advantage, improved decision making, internal efficiency, project improvement, etc. If you are interested in participating in the study, please email me at waad.khogaliali@ryerson.ca to schedule an interview date and time.

If you have further questions concerning matters related to this research, please contact:
Professor Phil Walsh, PhD., P.Geo
Associate Professor, Ted Rogers School of Management, Ryerson University
Telephone: (416) 979-5000 x2553
Email Address:prwalsh@ryerson.ca

This study has been reviewed and approved by the Ryerson University Research Ethics Board. If you have questions regarding your rights as a research participant in this study, please contact:

189

Toni Fletcher, Research Ethics Co-coordinator
Ryerson University
Telephone: (416)979-5000 ext. 7112.
Email: toni.fletcher@ryerson.ca

Thank you for your consideration. Your help is greatly appreciated.
Yours sincerely,
Waad Khogali

Details of Research Study

All information that you provide through your participation in this study will be kept confidential. Further, you and your firm will not be identified in the thesis or in any report or publication based on this research and only summary results from the entire study will be presented in the final report. There is no compensation for responding nor are there any known anticipated risks of concern to participation in this study. The data collected through this study will be kept for a period of less than 1 year in a secure location and destroyed once the data is analysed. Only my supervisor and I will have access to the data collected. Participation in this study is voluntary. You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. If you choose to withdraw from this study you may also choose to withdraw your data from the study. You may also choose not to answer any question(s). Your choice of whether or not to participate will not influence your future relations with Ryerson University.

**RYERSON
UNIVERSITY**

Ryerson University
350 Victoria Street
Toronto, Ontario
M5B 2K3
Main
Number :(416) 979 5000

CONSENT TO PARTICIPATE IN RESEARCH

"Managing sustainability knowledge in the Canadian mining industry"

You are being invited to participate in a research study. Please read this consent form so that you understand what your participation will involve. Before you consent to participate, please ask any questions necessary to be sure you understand what your participation will involve.

If you have further questions concerning matters related to this research, feel free to contact:

Professor Phil Walsh, PhD., P.Geo
Associate Professor, Entrepreneurship and Strategy
Ted Rogers School of Management
Ryerson University
Office: TRS 1-066
Telephone: (416)979-5000 x2553
Email Address:prwalsh@ryerson.ca

INVESTIGATORS

This research study is being conducted by Waad Khogali Ali under the supervision of Professor Phil Walsh from the Environmental Applied Science and Management program at Ryerson University.

PURPOSE OF STUDY

The purpose of the study is to identify and discuss KM techniques that are used to manage sustainability knowledge in the Canadian Mining Industry. In particularly, this study will seek to;

- Identify and discus the existing practices of sustainability knowledge acquisition, sharing and application within the mining industry in Canada.
- Identify and discuss knowledge management strategies, KM matrices, KM culture, KM technologies and the role played by senior management in promoting KM practices within their sustainability departments.
- Set recommendations to better manage sustainability knowledge in the mining industry.

DESCRIPTION OF THE STUDY AND YOUR PARTICIPATION

- You are being invited to participate in this research study by being involved in a semi-structured interview. The semi -structured interview will consist of open and closed ended questions inquiring how sustainability knowledge is managed in your firm.
- Completion of the interview will take 45 minutes to 1 hour of your time.
- The interviews will be held in your office or board room for convince purposes.
- If you are not available to meet personally, you have the option to participate via phone/Skype.

POTENTIAL RISKS AND DISCOMFORTS

The potential risks to the study are very low.

POTENTIAL BENEFITS TO PARTICIPANTS

The data collected from this study would be beneficial for future scholarly work on knowledge management. Additionally, the findings from this study may be beneficial to your firm as it will set forth recommendations on how better to manage sustainability knowledge, which may build benefits including a sustainable competitive advantage, improved decision making, internal efficiency, project improvement, etc.
I cannot guarantee, however, that you will receive any benefits from participating in this study.
PAYMENT FOR PARTICIPATION

You will not be paid to participate in this study.

CONFIDENTIALITY

All information that you provide through your participation in this study will be kept confidential. Further, you and your firm will not be identified in the thesis or in any report or publication based on this research and only summary results from the entire study   will be presented in the final report. The data collected through this study will be kept for a period of less than 1 year in a secure location and destroyed once the data is analysed.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

Participation in this study is voluntary. You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. If you choose to withdraw from this study you may also choose to withdraw your data from the study. You may also choose not to answer any question(s) or withdraw from the study. . Your choice of whether or not to participate will not influence your future relations with Ryerson University

QUESTIONS ABOUT THE STUDY

If you have any questions about the research now, please ask. If you have questions later about the research, you may contact:
Waad Khogali Ali
Email: Waad.khogaliali@ryerson.ca

This study has been reviewed by the Ryerson University Research Ethics Board.   If you have questions regarding your rights as a research participant in this study, please contact:
Toni Fletcher
Research ethics co-ordinator
Ryerson University
Telephone: (416)979-5000 ext. 7112.
Email: toni.fletcher@ryerson.ca

SIGNATURE OF RESEARCH PARTICIPANT

Your signature below indicates that you have read the information in this agreement and have had a chance to ask any questions you have about the study "Managing sustainability knowledge in the Canadian mining Industry"as described herein. Your questions have been answered to your satisfaction, and you agree to participate in this study. You have been given a copy of this form.

Name of participant (please print)

_____

Signature of participant   Date _____

_____

Section A: Introduction to Knowledge Management

Question A1

Have you ever heard of the term knowledge management as a business strategy concept?

10 | 5

- Yes
- No
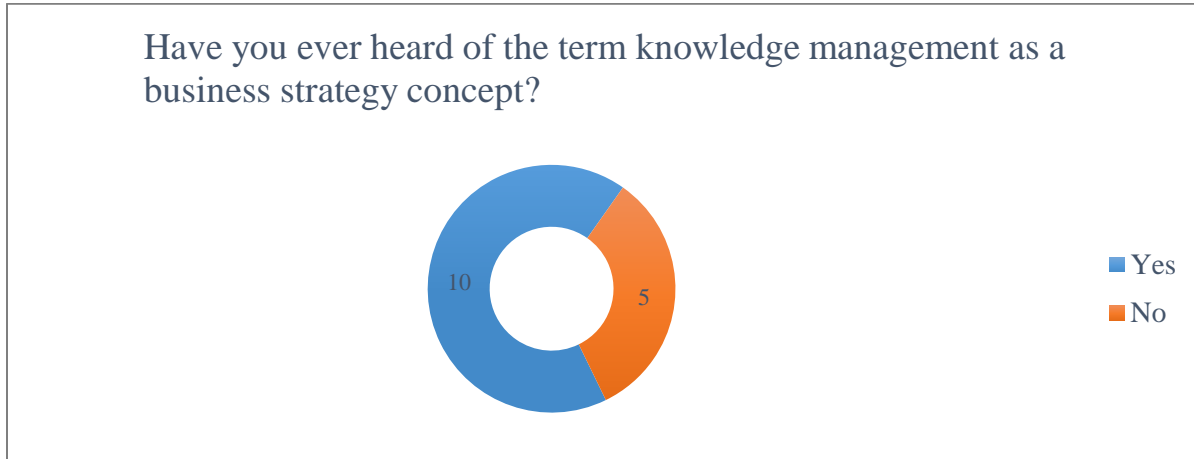
Section B: Knowledge Capture and /or creation

Question B1

Tacit knowledge capture at the individual and group levels

Category	Number of firms
Interviewing experts	6
Learning by being told	7
Learning by observation	8
Not done/Don't Know	4
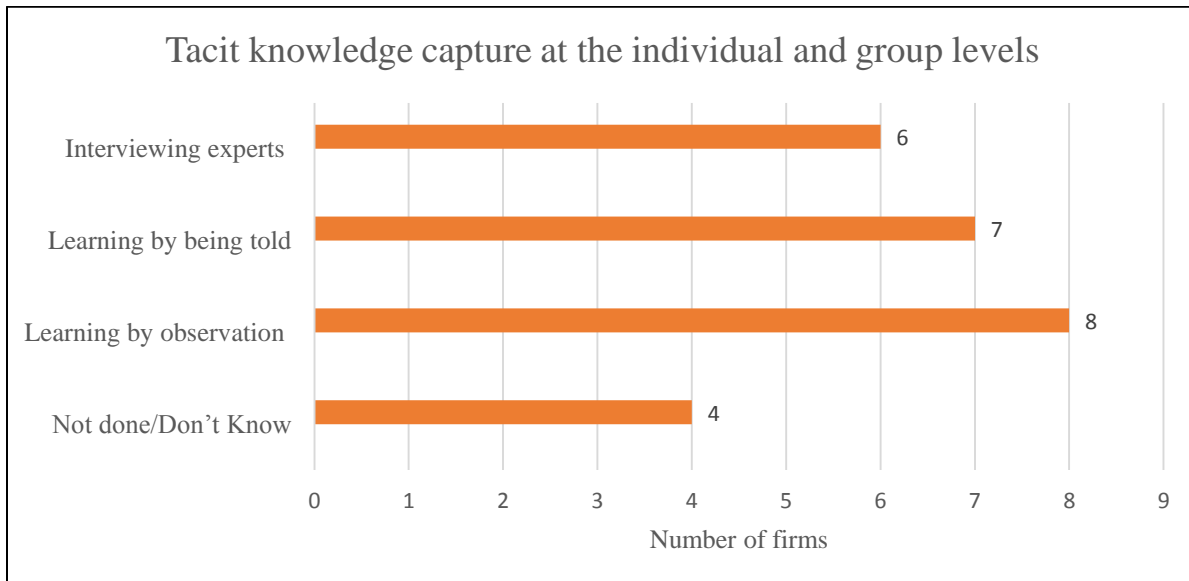
Comments:

Company B commented that capturing tacit knowledge is not captured systematically within their firm, but there is some ongoing discussions and genuine commitment to do so.

Company G commented that there has been no structured effort to capture valuable thoughts and experiences of employees.

Company J commented that tacit knowledge is ad-hoc- resides with the knowledge holder. No formal processes are in place for capturing of tacit knowledge.

Company E commented that other methods are used in capturing tacit knowledge. In particularly, company E said that thoughts and experience (tacit knowledge) are captured through various manners. Many employees are hired to fill a specific role based on their past experience- so they bring their thoughts into the role. Depending on the person and the role, there is also knowledge transfer through the sharing of information amongst team members, both vertically and horizontally (as in, colleague-to-colleague or manager-employee). The sustainability-related teams are lean in terms of resources – and therefore, one gap present is a lack of documentation around day-today job duties and tasks.

Company N commented that tacit knowledge is captured through the use of " learning by being told", "learning by observation" and" interviewing experts" as well as through video coverage, brainstorming and minutes writing at community meetings.

Question B2
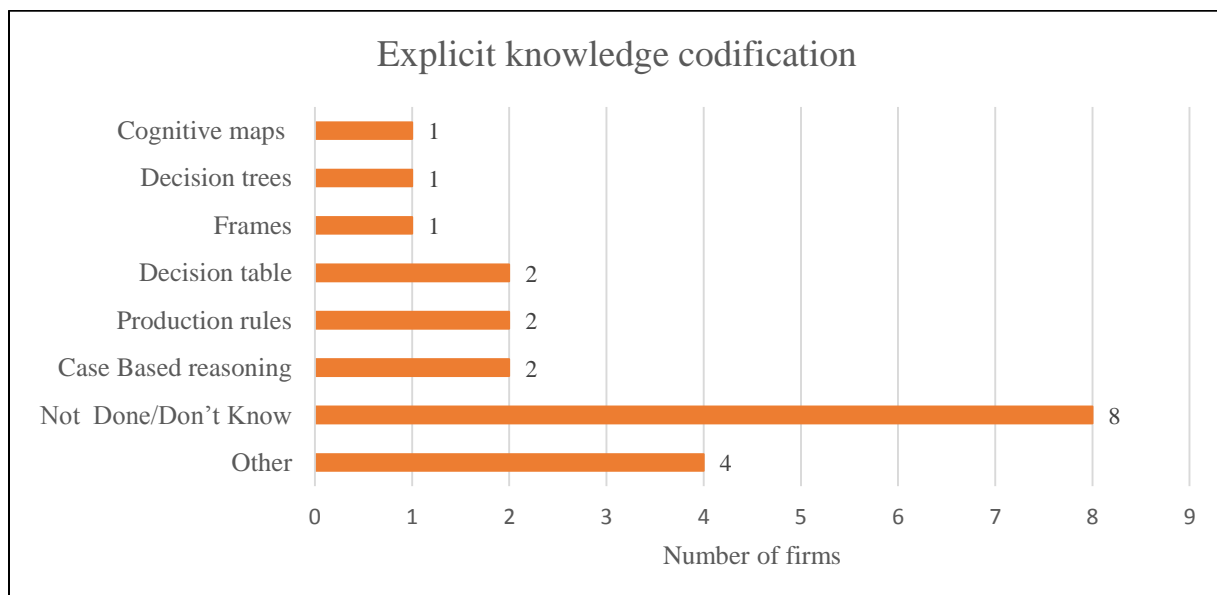
Comments:

Company A commented that the conversion of tacit knowledge to explicit knowledge is done through open discussions and meetings where employees take down notes in order to codify tacit knowledge into a more explicit form.

Company E commented that the sustainability-related teams are lean in terms of resources – and therefore, one gap present internally within the firm is the lack of documented information. While this doesn't hinder the day to day completion of tasks, it introduces inefficiencies in terms of transferring knowledge to new employees. When information is documented it is typically in the form of file notes, memos, or meeting minutes.

Company J commented that lessoned learned in the form of tacit knowledge between team members in a sustainability project are captured and put into a more explicit form using "After Action Reviews".

Question B3
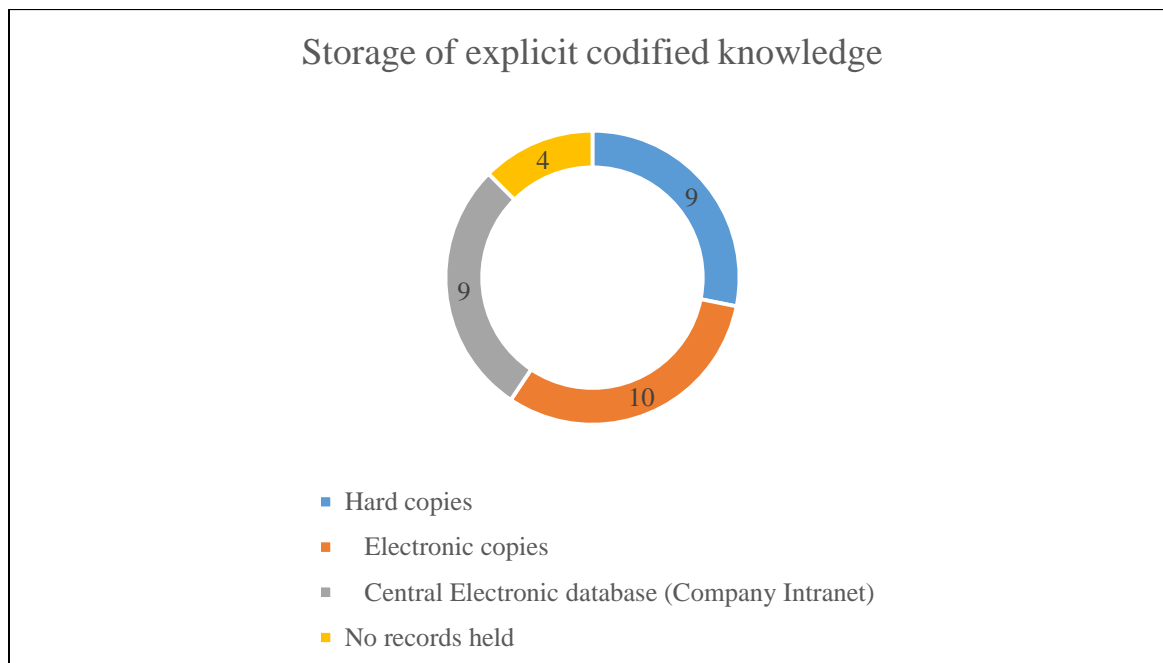
Storage of explicit codified knowledge

- Hard copies — 9
- Electronic copies — 10
- Central Electronic database (Company Intranet) — 9
- No records held — 4

Comments:

Company E commented that records are predominantly electronic and are maintained on a company shared drive. In terms of knowledge sharing /guidance to the firms operations, the firm has a SharePoint site where documents can be posted.

Company F commented that in addition to storing explicit knowledge on electronic copies and on a central electronic database (company intranet), the company has a "Data room"

Company K commented that in addition to storing explicit knowledge on hard copies, electronic copes and central electronic database (company intranet), they use share drives and Borealis/MS

Company N commented that explicit knowledge is also stored in existing common domain/drive and are accessible by members only.

Question B4

Staff access to the stored codified explicit knowledge	Number of firms
All employees	3
Employees working in the sustainability department	8
Specific people in the sustainability department	1
Don't Know/No records kept	4
Other	1

Comments:

Company E commented that the shared drives have permission limiting access. The SharePoint site that is used for file sharing with operations also has limited access, however, hundreds of employees have been given access, mostly of whom are outside the sustainability departments.

Company N commented that only employees working in the sustainability department have access to the codified explicit knowledge that is captures and stored AND that for confidentiality purpose, certain information cannot be accessed by contractors

Company F commented that although codified explicit knowledge can be accessed by all employees and employees working in the sustainability department, the "data room" is restricted to specific personnel in the organization or individuals who have signed a non-disclosure agreements.

Company J commented that access to information depends upon the set up when the file is saved to the electronic document management system (EDMS).

Question B5-B8

Question B9

Frequency of preventing loss of knowledge from retiring operations employees and other turnover

Question B10-B12

Project knowledge retention
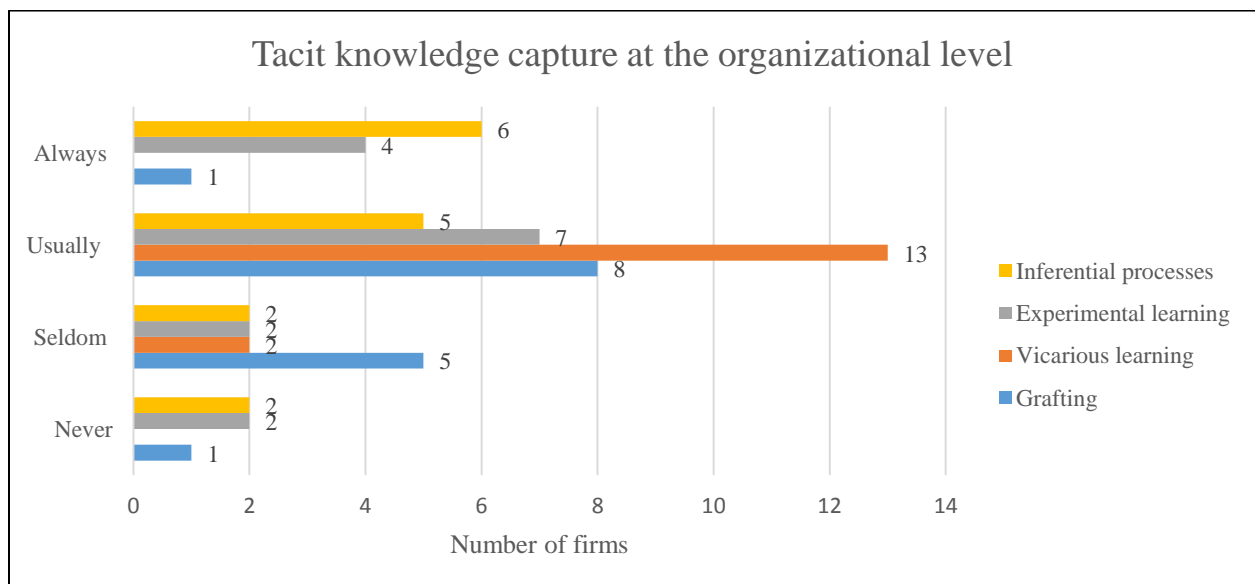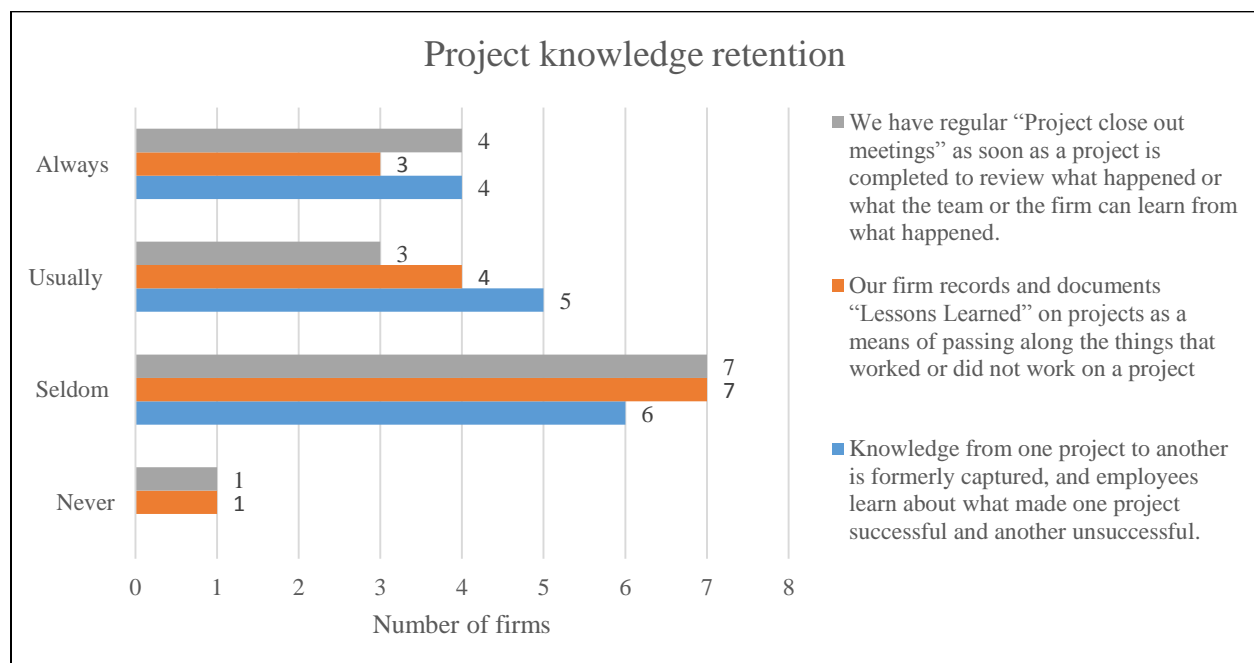
Comments:

Company L commented that transferring of "lessons learned" from one project to the next does not occur well enough. Additionally, databases are not fully utilized to capture lessons learned from one project to the next. Learning is ignored when a project goes well and is only recognized when a project hits a problem.

Company M commented that Knowledge from one project to another is not well captured and employees rarely learn about what made one project successful and another unsuccessful.

Company O commented that although "lessons learned" is part of an every project, and that "one must also challenge projects to think about "lessons retained"

Question B14

Techniques of pre-empting the risk of losing vital sustainability knowledge from departing employees.	Number of firms
Structured interviews	6
Knowledge transfer techniques	3
Other	1
Don't Know/Not done	5

Comments:

Company J commented that it utilizes infrequent knowledge capture or exit interviews in order to pre-empt the risk of losing vital sustainability knowledge from departing employees.

Company E commented that frequently, minimal knowledge transfer occurs from departing employees. On occasion, a week or two's overlap is present. In some cases, "departing" employees are simply changing roles or departments, and so their knowledge is still retained in the company for access.

Company X commented that it utilizes exit interviews to pre-empt the risk of losing vital sustainability knowledge from departing employees.

Section C: Knowledge sharing and learning

Question C1

Sharing of sustainability knowledge

CoP esist throughout, are maintained and monitored — 9
CoP exist for someprojects — 3
CoP are rare. — 2
There is no sharing of knowledge through peer or social networks. — 1

Number of firms
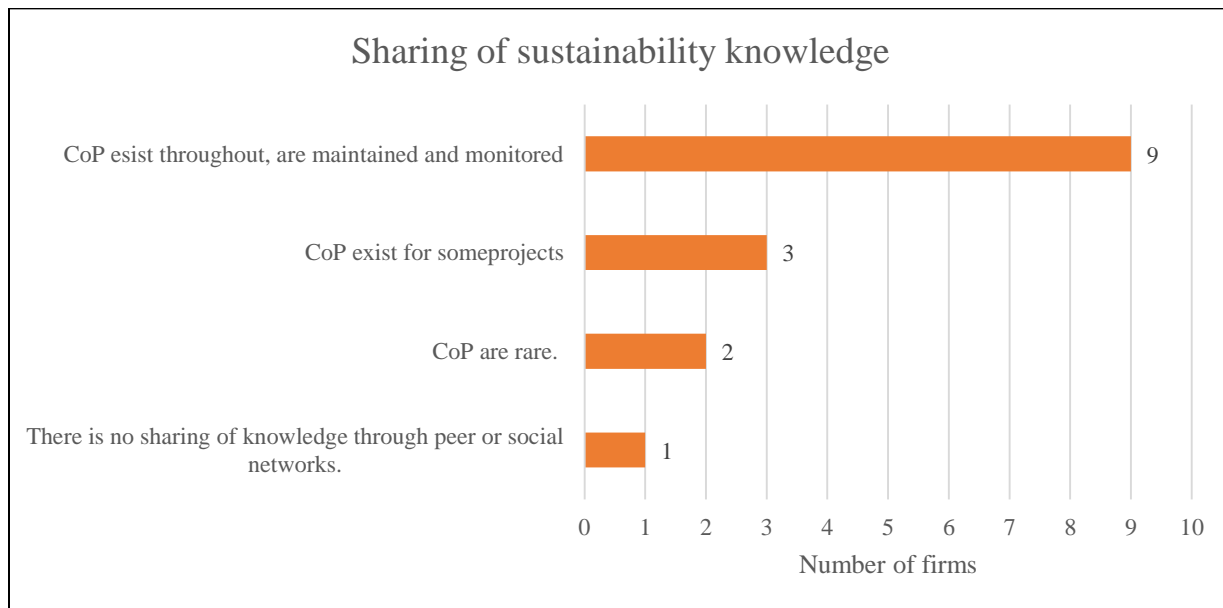
Comments:

Company E commented that "at E, they have sustainability related departments, however, they're not named "Sustainability". Sustainability related topics – e.g. water, energy, biodiversity, and communities – are natural business functions for our company, and have implications across all departments. We have "leads" for these areas at our operations as well as in our corporate office, as well as communities of practice linking our head office departments and our sites"

Company O commented that there are sharing networks but there is no formal process in place for sharing sustainability information.

Question C3

Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?	Percentage of respondents (Firms)
Yes we do through social network analysis charts	0
Yes we do through organizational charts	6
Don't Know/Not done	9

Comments:

Company O commented that the firm has begun the process of mapping relations on information flows, but the process is new. Therefore the firm relies on individuals' experience and memory.

Company E commented that "visually mapping of the relations between people in order to identify knowledge flows "occurs more typically through general conversation and interaction through the firm's offices. While organizational charts are sometimes used, they are only a tool. Conversation/discussion amongst employees is the more common route for "mapping" the relationships for knowledge flows.

Question C4

Frequency of techniques and technologies to share sustanability knowledge
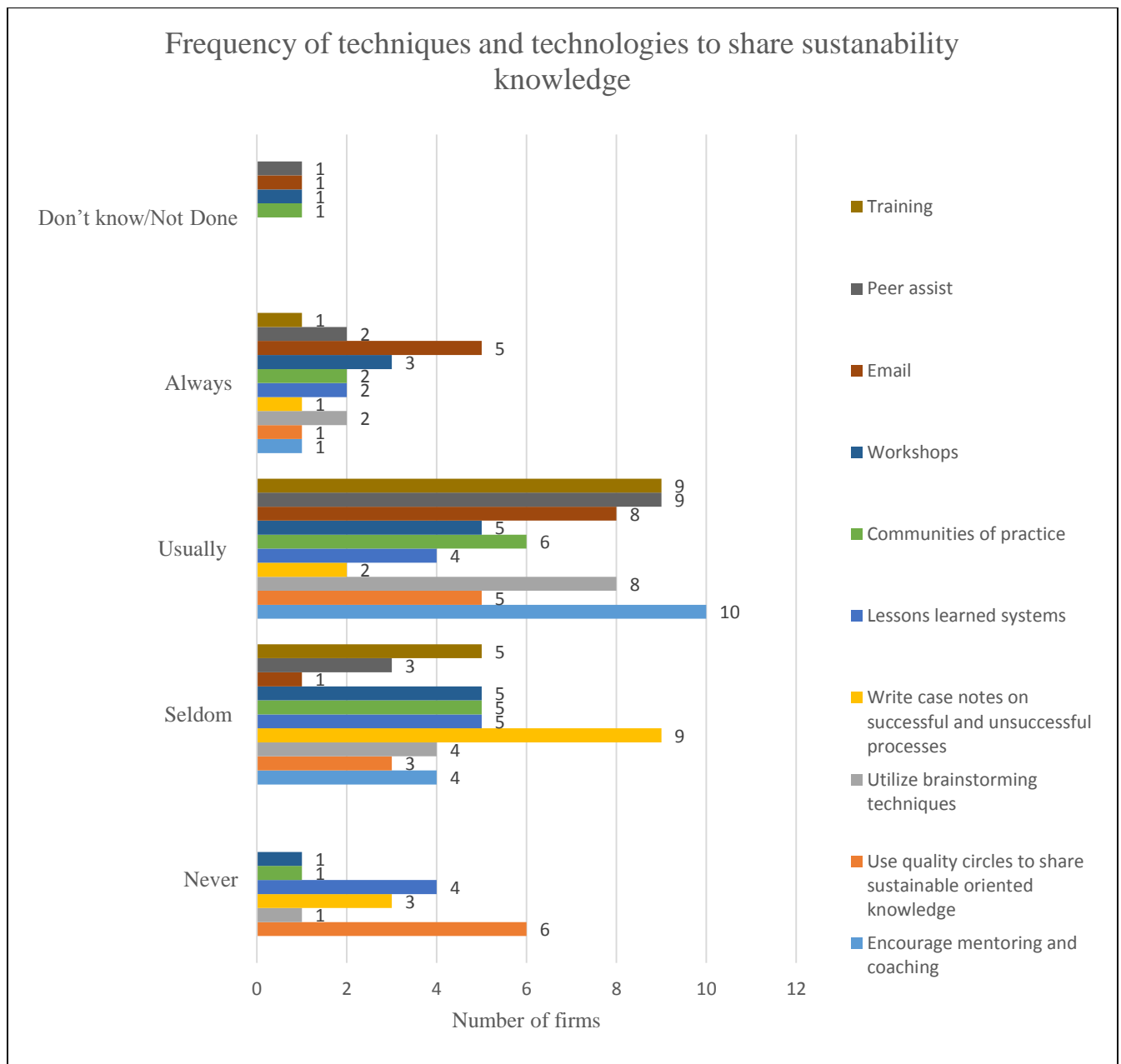
Comments:

Company N commented that the company has a Knowledge broker, knowledge repositories (database), master – apprentices relationship, information sharing forums and expert directories to share knowledge

Question C5

Do good ideas through knowledge sharing lead to best practices?

Don't Know — 1
Always — 2
Usually — 11
Never — 1

Number of firms
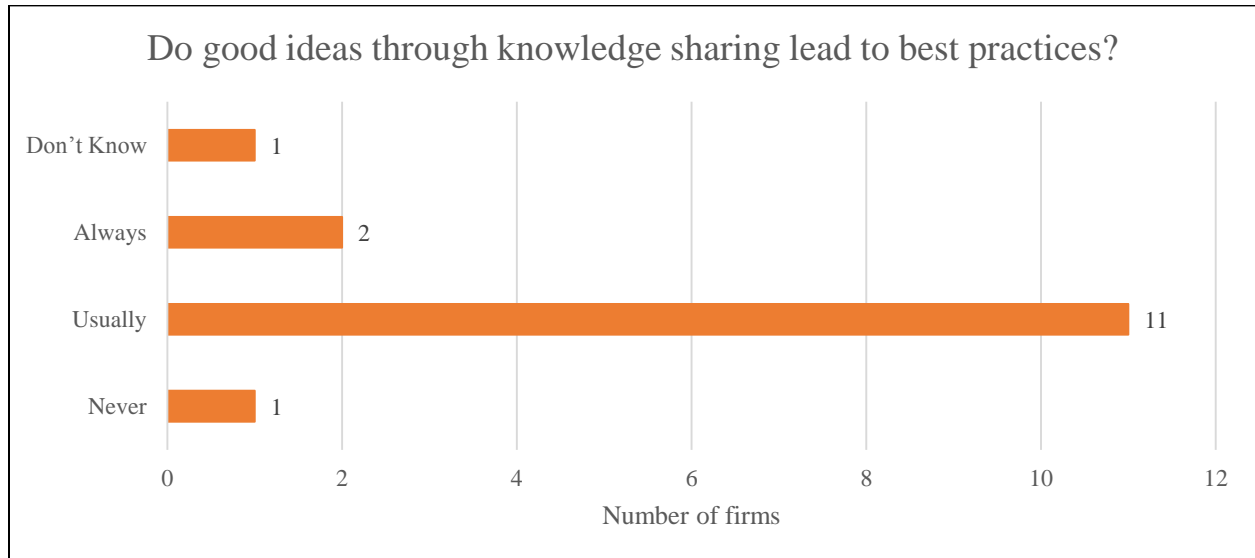
Comments:

Company J commented that good ideas through knowledge sharing leads to best practices depending on certain departmental areas i.e. in safety always, in environment and communities, sometimes and in heath rarely.

Company E commented that conceptually, good ideas through knowledge sharing leads to best practices, however, there are numerous examples where the sharing of knowledge doesn't lead to best practices, but the issue in that case isn't necessarily the poor sharing of information, as much as the limitations of an employee. In essence, best practices are not achieved exclusively through knowledge sharing.

Question C6

Sharing and maintaining best practices

Best practises are not stored or available for future re-use — 1
Best practices are made available to a small portion of staff and not routinely updated — 9
Best practises are stored, shared, constantly maintained and updated — 5

Number of firms
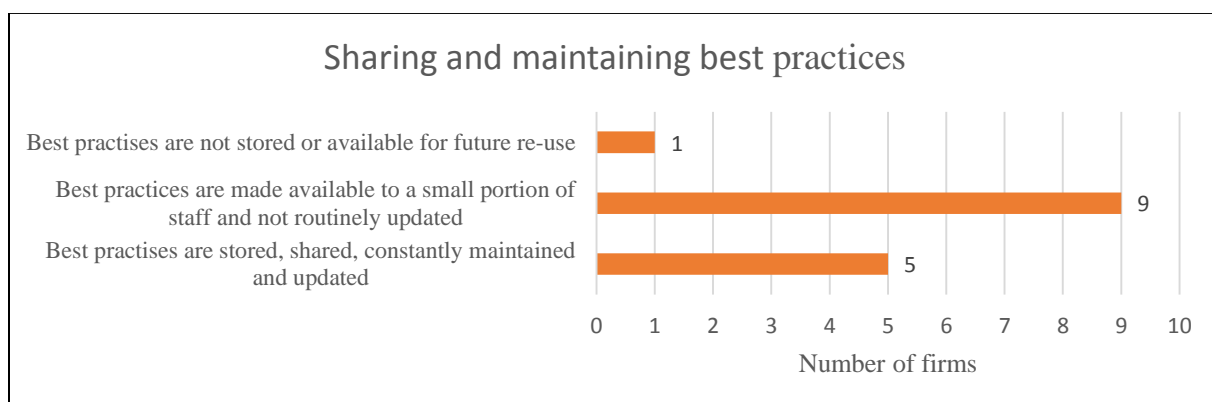
Comments:

Company D commented that there is no formal program to share knowledge within the firm.

Company E commented that information is documented largely on an ad hoc basis, with the exception of guidance documents written/generated for the purposes of supporting the firms operations.

Question C8

a) Frequency of learning at the start of a new project

Category	Number of firms
Never occurs	1
Is rare	1
Happens some of the time	7
Happens all the time	5

Question C9

b) Frequency of learning during a project

Category	Number of firms
Never occurs	1
Is rare	0
Happens some of the time	8
Happens all the time	5
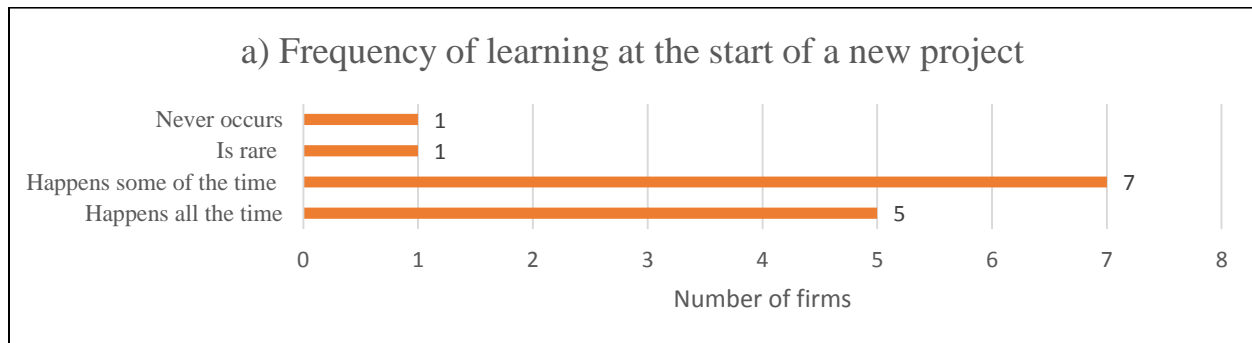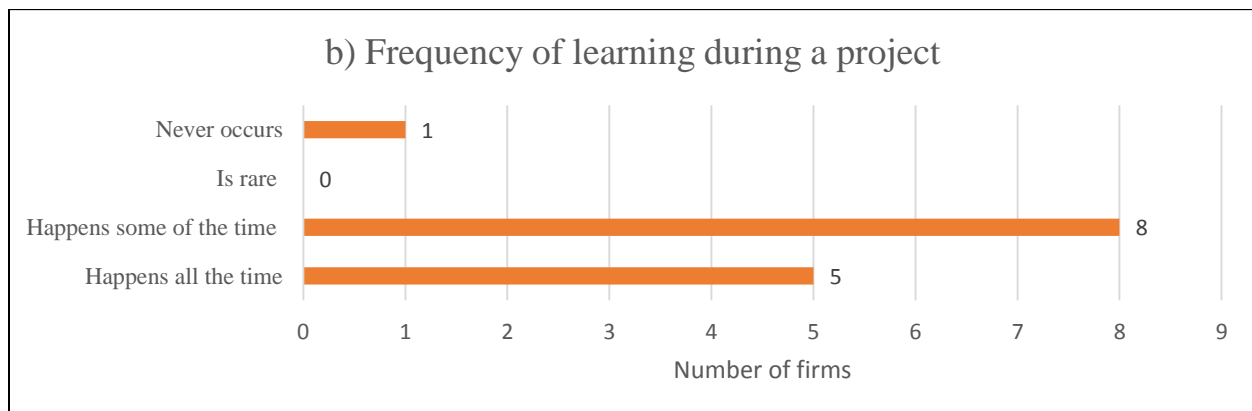
Comments:

Company E commented that within their firm, information sharing is excellent. However, given that the question refers to a "project", most project work in the firm is focused on resource development projects, which pulls together team members from various departments. Given the various knowledge backgrounds and variety of projects, the discussion of learning varies.

Therefore, teams discuss their learning during a project some of the time within the suitability department.

Question C10

c) Frequency of capturing and documenting new knowledge to share with others at the end of a project

Category	Number of firms
Never occurs	2
Is rare	0
Happens some of the time	9
Happens all the time	3
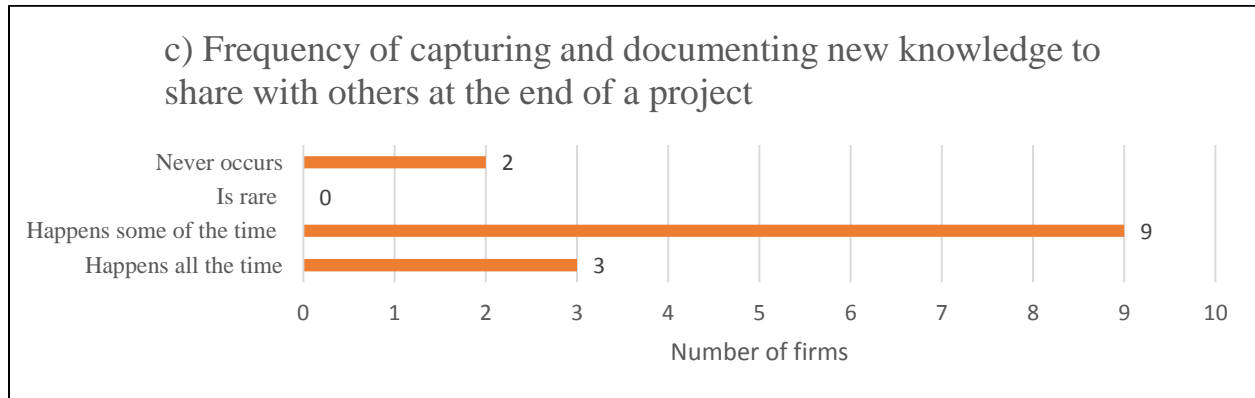
Comments:

Company E commented that capturing and documenting new knowledge to share with other at the end of a project is occurring in an increasing fashion.

Question C11

Knowledge sharing barriers

Category	Number of firms
Lack of effective communication	1
Organizational culture does not create a climate of trust	2
Conception that knowledge is property	1
Different Languages	3
Don't know who to share with	2
Don't know what to share	2
Lack of time	5
Lack of systems to support sharing	2
Don't Know of any knowledge sharing barriers	1

Comments:

Company K commented that there is a lack of systems to support sharing processes.

Company J commented that there is an absence of formal knowledge capture/transfer systems

Company N commented that top-down approach sometimes inhibits subordinate employees to access the knowledge

Company E commented that when it comes to sustainability information – employees tend to work quite collaboratively. The biggest challenges are probably time limitations (employees have too much to do and don't have time to share) and geography (Company N has multiple offices and operations, and employees don't necessarily interact with one another frequently across offices/operations)

Section D: Knowledge acquisition and application

Question D3- Knowledge reuse

Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?	Number of firms
Yes	13
No	1

Comments:

Company N commented that "Innovations adding up to efficiency and effectiveness are welcome"

Company E commented that It is a common practice for employees in the firm to learn from others work/leverage past experiences. The firm often uses a pilot approach model, wherein one site tests an approach, and if successful, is then shared with other sites.

Question E2

Organizational culture support for KM

Question E3

Organizational culture support for knowledge sharing

Category	Number of firms
Knowledge sharing is the norm . Employees feel they should share	10
Knowledge sharing is a neutral behaviour. Neither desirable nor undesiarable	3
Few people are open to sharing and reusing knowledge	0
Management and employees are not supportive to knowledge sharing .	1

Number of firms

Question E4

Barriers to a cultural change needed for KM to succeed

Category	Number of firms
Lack of time and meeting places	10
Rewarding of knowledge hoarding	4
Lack of absorptive capacity	4
Intolerance for mistakes	4
Lack of common language	4

Number of firms

Comments:

Company N commented that lack of mutual trust and confidence is a barrier to the cultural change needed for KM to succeed

Section F: Knowledge Management Team

Question F1

Knowledge Management roles

- Don't Know

- Knowledge roles are established in the sustainability department

- Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).

- There are no defined knowledge Management roles in the sustainability department of the firm
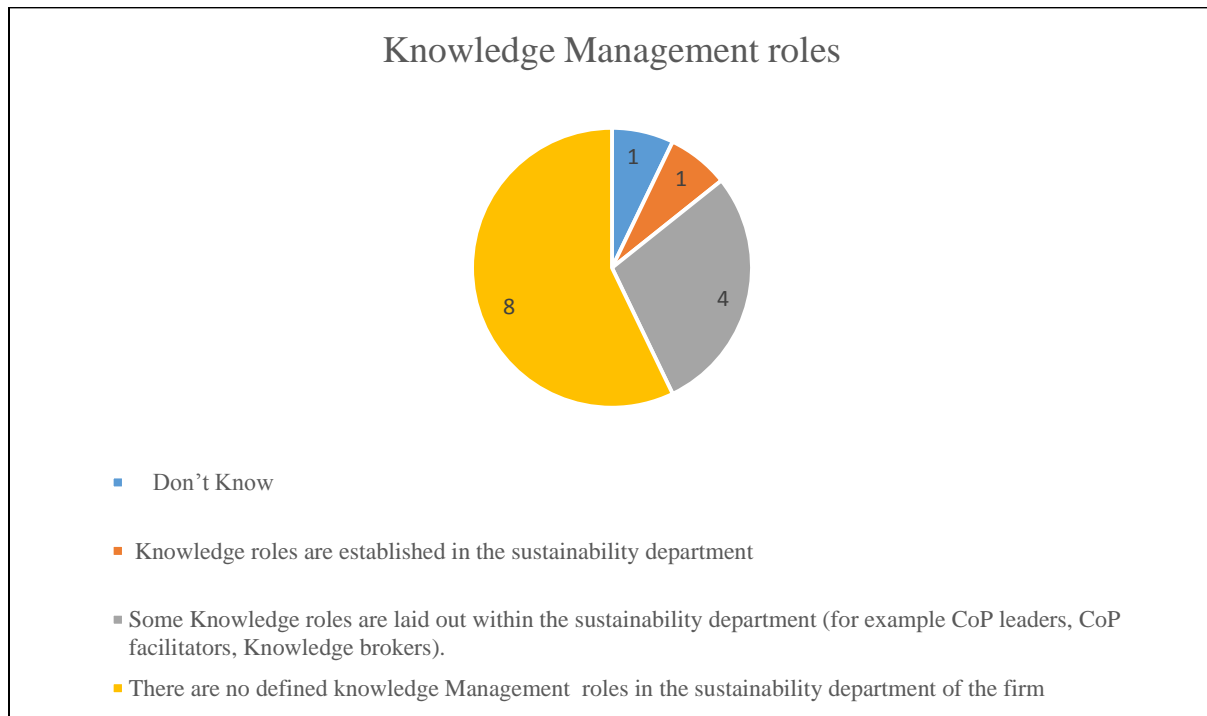
Section G: Knowledge Management tools and technologies

Question G1

Knowledge Management Tools and Technologies
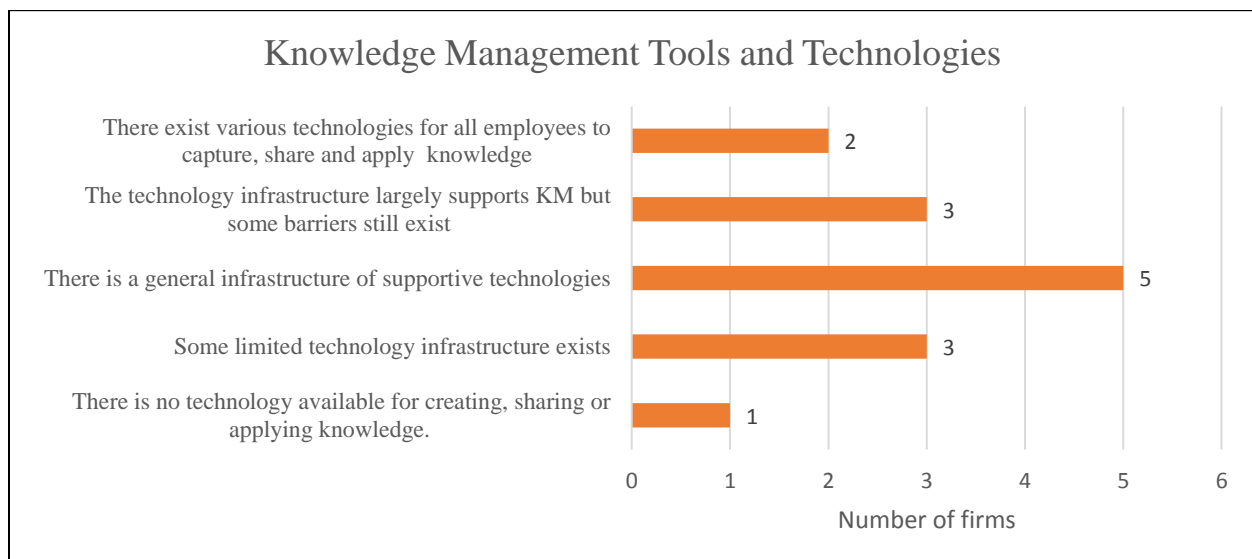
Section H: Knowledge Management strategy

Question H1

Knowledge Management Strategy

Category	Number of firms
Knowledge management is fully fixed into the business processes	2
Some business areas or projects have defined critical Knowledge areas, which they manage	8
Knowledge management is not linked to the business processes of the firm	4

Number of firms (axis 0–9)
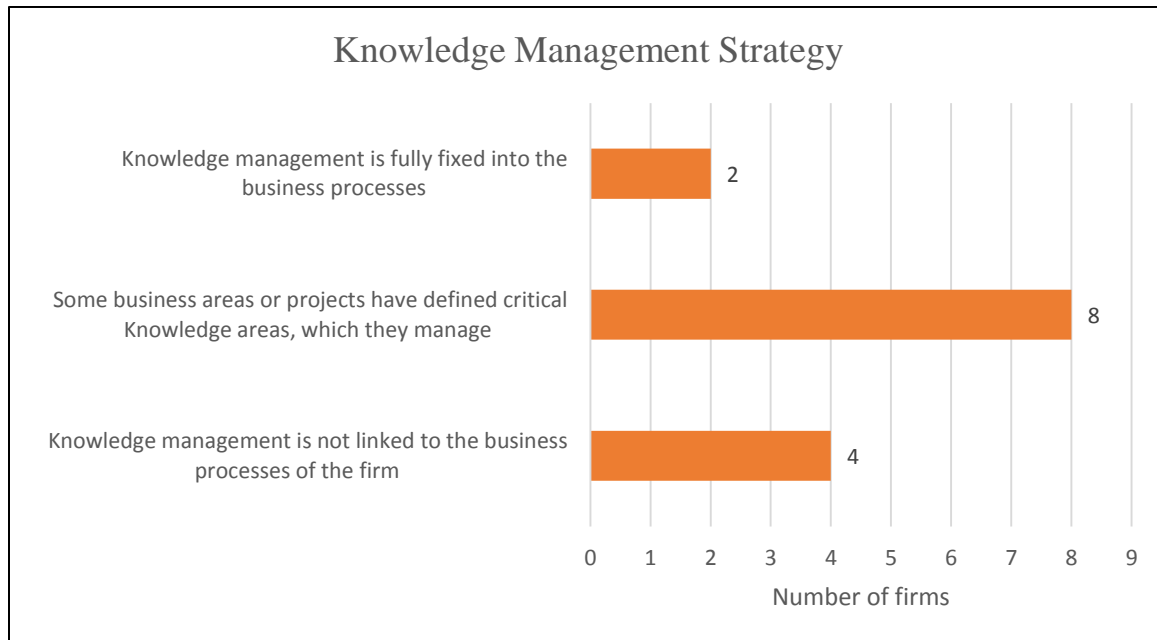
Comments:

Company N commented that a KM strategy exists, and supports the following Knowledge processes, however, it is not integrated with the overall goals of the firm.

Company E commented that it does not have a formal "strategy" around KM, although their management understands the value in sharing information and passing it onto new employees.

Question H2

How closely is KM linked to the business strategy

- Knowledge management is fully fixed into the business processes — 14%
- Some business areas or projects have defined critical Knowledge areas, which they manage — 64%
- Knowledge management is loosely linked to the business processes of the firm — 0%
- Knowledge management is not linked to the business processes of the firm — 29%

Percentage of respondents (Firms)

Section I: Knowledge Management metrics

Question I1

Monitoring of how well KM is succeeding and how well it has helped attain organizational goals

- Balanced Score card method — 2
- Result base management accountability framework… — 2
- Benchmarking against industry practises — 4
- House of Quality method — 1
- Not done — 10

Number of firms

Comments:

Company N commented that "employees' performance appraisal" is used as a metrics tool of how well employees are managing knowledge.

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

b) **Yes**   b) No

> Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are** understandable once an employee watches an expert do what he knows what to do).

d) Other:
   f) Don't Know

g

Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

   a) Cognitive maps
   b) Decision trees
   c) Frames
   d) Decision table
   e) Production rules
   f) Case Based reasoning
   g) Don't Know
   h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

   a) Hard copies
   b) Electronic copies
   c) Central Electronic database (Company Intranet)
   d) No records held
   e) Don't Know

Comments:

B4. Who has access to the information recoded in question B3?

   a) All employees
   b) Employees working in the sustainability department
   c) Specific people in the sustainability department
   d) Don't Know

N/A

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was		x				

not previously available within the firm						
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			x			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing		x	x			
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.				x		
B9.We prevent loss of knowledge from retiring operations employees and other turnover					x	
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.			x			Via precedent documents
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.	x					
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.	x					

B13.How is the information from the capturing methods in Questions B5 to B8 held?

    a) Hard copies
    b) Electronic copies
    c) Central Electronic database (Company Intranet)
    d) No records held
    e) Don't Know
    f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

      a) Structured Interviews
      b) Knowledge Transfer Techniques
      c) Other:
      d) Don't Know

Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

      a) There is no sharing of knowledge through peer or social networks.
      b) Communities of practice (CoP) and knowledge-sharing networks are rare.
      c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
      d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
      e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

|	Never	Seldom	Usually	Always
Have a discussion with other colleges				x
Conduct their own research			x	
Look into the firms database			x	
Access Hard copy files		x		
Google			x	
Read a manual		x		
Attend a training course			x	
Ask a community of practice		x		
Ask a social network			x	

Other:

Comments:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

- a) Yes we do through Social network Analysis Charts
- **b) <u>Yes we do through Organizational charts</u>**
- c) Other
- d) Don't Know

Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge		x			
Utilize brainstorming techniques			x		
Write case notes on successful and unsuccessful processes	x	x			
Lessons learned systems	x	x			
Communities of practice		x			
Workshops		x			
Email			x		
Peer assist			x		
Training			x		

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

- a) Never
- b) Seldom
- **c) <u>Usually</u>**
- d) Always
- e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
c) **Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.**
d) Other
e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

a) **Verbally at team meetings**
b) Written instructions
c) Ad- hoc verbally
d) **Intranet**
e) Video
f) Training
g) Mentoring
h) on the job training
i) Communities of practice
j) Don't know
k) Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
b) Is rare within the suitability department. Only a few projects will learn from others before they start.
c) **Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine**
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) **Is rare within the sustainability department**
c) Happens some of the time within the sustainability team. It is applied in certain tasks.
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) **Different Languages**
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) Other:

Comments:

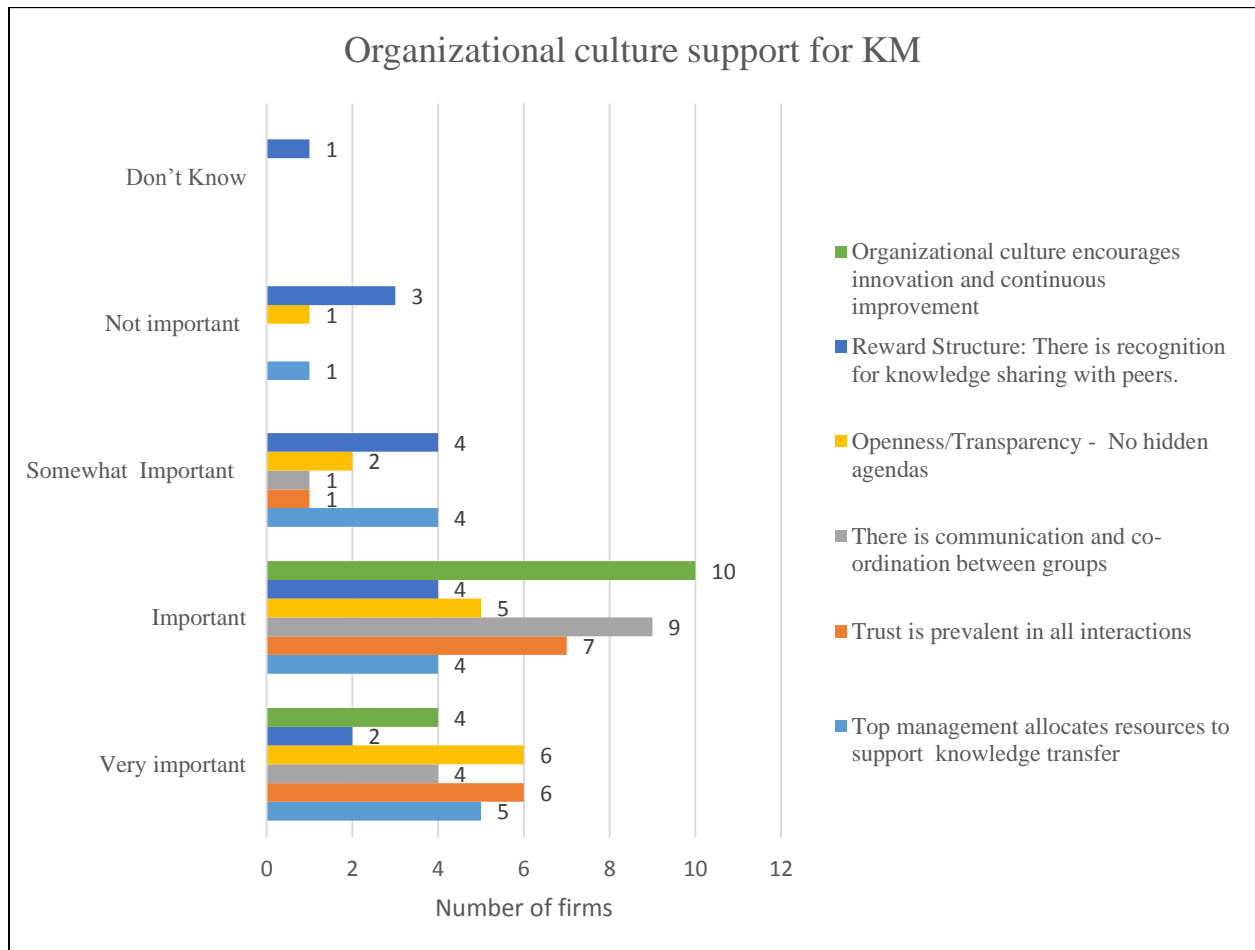**Section D: Knowledge Acquisition and Application**

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:
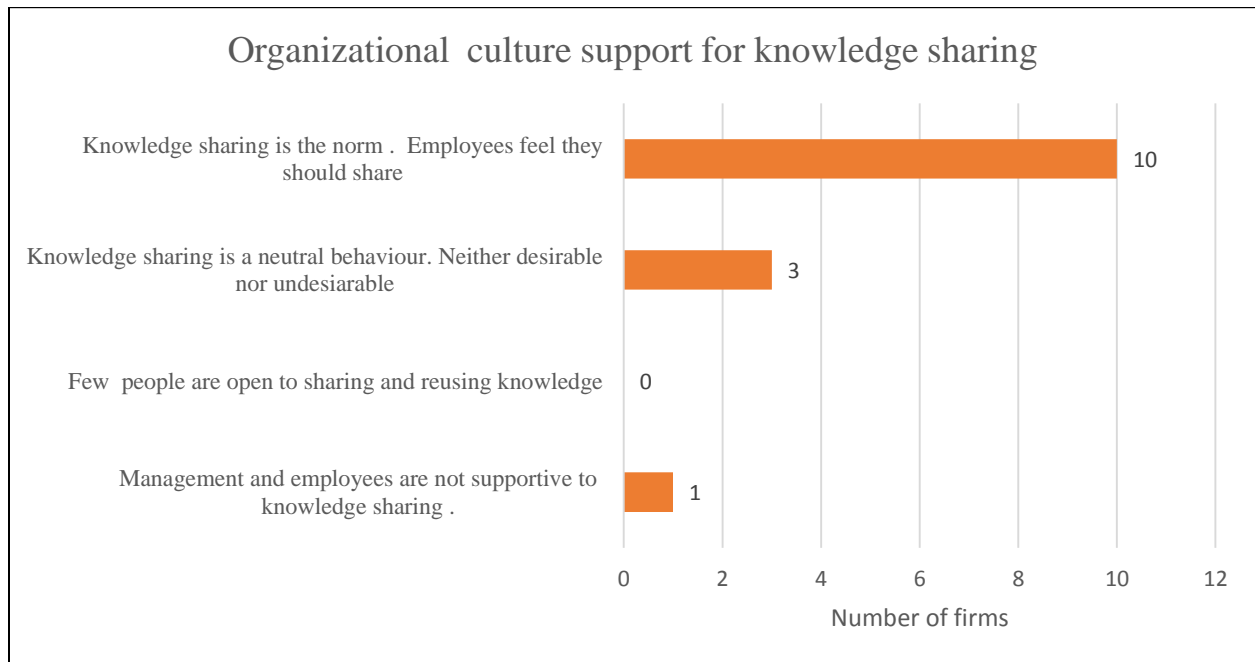
Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x	x	
Operations staff has the information they need, when they need it			x	x	

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	x					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques					x	

221

Nobody challenge's the status quo		x				
Employees have to do things the official way, even if there is a better way of doing it	x					
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	x					
Staff have complete freedom to learn from each other without management oversight				x		
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x		
Openness is valued in the organization					x	
People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability department is very weak.		x				

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
d) **Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share**

e) Don't Know

Comments:	

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer			x		
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas		x			
Reward Structure: There is recognition for knowledge sharing with peers.		x	x		
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

   a) **Lack of Time and meeting places**
   b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
   c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
   d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
   e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
   f) Others
   g) Don't Know

Comments:	

223

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) **There are no defined knowledge Management roles in the sustainability department of the firm**
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

> Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) **The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people**
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

> Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) **A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.**

c) **<u>There are ongoing discussions within the firm to try and develop a knowledge management strategy</u>**

d) Few people express that knowledge is significant to the firm.

Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) **<u>Some business areas or projects have defined critical Knowledge areas, which they manage</u>**
d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method
d) Result based management accountability framework (RMAF)
e) **Don't know/Not done**
f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

c) **Yes**   b) No

Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
c) Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d) **Other:**
e) Don't Know

> Comments: not done in a systematic way but there is a genuine commitment to do it

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

- a) Cognitive maps
- b) Decision trees
- c) Frames
- d) Decision table
- e) Production rules
- f) Case Based reasoning
- **g) Don't Know/Not done**
- h) Other:

> Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

- **a) Hard copies**
- **b) Electronic copies**
- c) Central Electronic database (Company Intranet)
- d) No records held
- e) Don't Know

> Comments:

B4. Who has access to the information recoded in question B3?

- a) All employees
- **b) Employees working in the sustainability department**
- c) Specific people in the sustainability department
- d) Don't Know

> Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that	x					

was not previously available within the firm						
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			x			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing				x		
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.			x			
B9.We prevent loss of knowledge from retiring operations employees and other turnover		x				
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.			x			
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.			x			
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.		x				

B13.How is the information from the capturing methods in Questions B5 to B8 held?

a) **Hard copies**
b) **Electronic copies**
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know
f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

    a) <u>Structured Interviews</u>
    b) Knowledge Transfer Techniques
    c) Other:
    d) Don't Know

> Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

    a) There is no sharing of knowledge through peer or social networks.
    b) <u>Communities of practice (CoP) and knowledge-sharing networks are rare.</u>
    c) <u>Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department</u>
    d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
    e) Don't Know

> Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research			x	
Look into the firms database	x			
Access Hard copy files		x		
Google				x
Read a manual			x	
Attend a training course		x		
Ask a community of practice			x	
Ask a social network		x		

Other:

Comments:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

  a) Yes we do through Social network Analysis Charts
  b) Yes we do through Organizational charts
  c) Other
  d) Don't Know

Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge			x		
Utilize brainstorming techniques			x		
Write case notes on successful and unsuccessful processes		x			
Lessons learned systems	x				
Communities of practice			x		
Workshops				x	
Email			x		
Peer assist			x		
Training		x			

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

  a) Never
  b) Seldom
  c) Usually
  d) Always
  e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

   a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
   b) **Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated**.
   c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
   d) Other
   e) Don't know

   Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

   a) **Verbally at team meetings**
   b) Written instructions
   c) **Ad- hoc verbally**
   d) Intranet
   e) Video
   f) Training
   g) **Mentoring**
   h) **on the job training**
   i) **Communities of practice**
   j) Don't know
   k) Other:

   Comments:

C8. How frequently does learning at the start of a new project occur?

   a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
   b) **Is rare within the suitability department. Only a few projects will learn from others before they start.**
   c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
   d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
   e) Don't Know

   Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) Happens some of the time within the suitability department. It is applied in certain tasks.
d) **Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.**
e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) Is rare within the sustainability department
c) **Happens some of the time within the sustainability team. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) **Other:**

Comments: lack of time

Section D: Knowledge Acquisition and Application

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

    a) <u>Yes</u>
    b) No
    c) Don't Know
    d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x		
Operations staff has the information they need, when they need it			x		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	x					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques	x					
Nobody challenge's the status quo	x					

Employees have to do things the official way, even if there is a better way of doing it	x					
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	x					
Staff have complete freedom to learn from each other without management oversight				x		
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x		
Openness is valued in the organization					x	
People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.

b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.

c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others

d) <u>Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share</u>

e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer				x	
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas		x			
Reward Structure: There is recognition for knowledge sharing with peers.		x			
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) <u>Lack of Time and meeting places</u>
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others

g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) **There are no defined knowledge Management roles in the sustainability department of the firm**
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) **There is no technology available for creating, sharing or applying knowledge.**
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this

b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.

c) There are ongoing discussions within the firm to try and develop a knowledge management strategy

d) Few people express that knowledge is significant to the firm.

Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm

b) Knowledge management is loosely linked to the business processes of the firm

c) Some business areas or projects have defined critical Knowledge areas, which they manage

d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.

e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises

b) Balanced Score card method

c) House of Quality method

d) Result based management accountability framework (RMAF)

e) Don't know

f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

d)   Yes   **b) No**

Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a)   Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b)   Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
c)   Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d)   Other:
e)   Don't Know
f)

Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you

firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments:

B4. Who has access to the information recoded in question B3?

A. **All employees**
B. Employees working in the sustainability department
C. Specific people in the sustainability department
D. Don't Know

Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm			x			
B6. We capture knowledge by observing other firms			x			

demonstration of techniques or procedures						
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing			x			
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.			x			
B9.We prevent loss of knowledge from retiring operations employees and other turnover			x			We are trying to implement a comprehensive knowledge retention program, to capture key knowledge from retiring staff.
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.		x				
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.		x				
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.			x			

B13.How is the information from the capturing methods in Questions B5 to B8 held?

    A. Hard copies
    B. Electronic copies
    C. Central Electronic database (Company Intranet)
    D. No records held
    E. Don't Know

F. Other:

> Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

A. **<u>Structured Interviews</u>**
B. Knowledge Transfer Techniques
C. Other:
D. Don't Know

> Comments: we sometimes use exit interviews which are a form of structured interviews.

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

A. There is no sharing of knowledge through peer or social networks.
B. Communities of practice (CoP) and knowledge-sharing networks are rare.
C. Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
D. **<u>CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned</u>**
E. Don't Know

> Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research			x	
Look into the firms database		x		
Access Hard copy files			x	
Google			x	
Read a manual		x		
Attend a training course			x	
Ask a community of practice			x	

Ask a social network			x	

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

    A. Yes we do through Social network Analysis Charts
    B. Yes we do through Organizational charts
    C. Other
    D. Don't Know-not done

Comments:

Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching		x			
Use quality circles to share sustainable oriented knowledge			x		
Utilize brainstorming techniques			x		
Write case notes on successful and unsuccessful processes		x			
Lessons learned systems			x		
Communities of practice			x		
Workshops		x			
Email			x		
Peer assist			x		
Training			x		

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)
    A. Never
    B. Seldom
    C. Usually
    D. Always
    E. Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

    A. None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
    B. **Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated**.
    C. Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
    D. Other
    E. Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

    A. Verbally at team meetings
    B. Written instructions
    C. Ad- hoc verbally
    D. **Intranet**
    E. Video
    F. Training
    G. Mentoring
    H. on the job training
    I. Communities of practice
    J. Don't know
    K. Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

    A. Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
    B. Is rare within the suitability department. Only a few projects will learn from others before they start.
    C. Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
    D. **Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon**
    E. Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) Happens some of the time within the suitability department. It is applied in certain tasks.
d) **Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.**
e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) Is rare within the sustainability department
c) Happens some of the time within the sustainability team. It is applied in certain tasks.
d) **Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.**
e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) **Different Languages**
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) Other:

Comments: we are located in several countries and sometimes the geographic distribution of our workforce leads to issues such as different languages which can be an obstacle for knowledge sharing

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

    a) <u>**Yes**</u>
    b) No
    c) Don't Know
    d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements				x	
Operations staff has the information they need, when they need it			x		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	x					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for			x			

political cliques						
Employees have to do things the official way, even if there is a better way of doing it		x				
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	x					
Staff have complete freedom to learn from each other without management oversight					x	
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating					x	
Openness is valued in the organization					x	
People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
d) **Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share**
e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know/not done
Top management allocates resources to support knowledge transfer		x			
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas		x			
Reward Structure: There is recognition for knowledge sharing with peers.					x
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) **Lack of Time and meeting places**

b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know – not done

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

- a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
- **b) <u>A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.</u>**
- c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
- d) Few people express that knowledge is significant to the firm.

Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

- **a) <u>Knowledge management is not linked to the business processes of the firm</u>**
- b) Knowledge management is loosely linked to the business processes of the firm
- c) Some business areas or projects have defined critical Knowledge areas, which they manage
- d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
- e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

- a) Benchmarking against industry practises
- b) Balanced Score card method
- c) House of Quality method
- d) Result based management accountability framework (RMAF)
- **e) <u>Don't know-not done</u>**
- f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

   e)   Yes   **b) No**

> Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)**
c) Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d) Other:
e) Don't Know

> Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

- a) Cognitive maps
- b) Decision trees
- c) Frames
- d) Decision table
- e) Production rules
- f) Case Based reasoning
- g) Don't Know
- **h) Other:**

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

- a) Hard copies
- b) Electronic copies
- c) Central Electronic database (Company Intranet)
- **d) No records held**
- e) Don't Know

Comments:

B4. Who has access to the information recoded in question B3?

- a) All employees
- b) Employees working in the sustainability department
- c) Specific people in the sustainability department
- d) Don't Know

Comments: N/A

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know/not done	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm			x			
B6. We capture knowledge by observing other firms demonstration			x			

of techniques or procedures						
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing				x		
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.				x		
B9.We prevent loss of knowledge from retiring operations employees and other turnover					x	
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.				x		
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.		x				
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.				x		

B13.How is the information from the capturing methods in Questions B5 to B8 held?

    a) Hard copies
    b) Electronic copies
    c) Central Electronic database (Company Intranet)
    d) No records held
    e) Don't Know
    f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

    a) Structured Interviews
    b) Knowledge Transfer Techniques

c) Other:
d) Don't Know

> Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

  a) There is no sharing of knowledge through peer or social networks.
  b) Communities of practice (CoP) and knowledge-sharing networks are rare.
  c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
  d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
  e) Don't Know

> Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research				x
Look into the firms database		x		
Access Hard copy files	x			
Google			x	
Read a manual		x		
Attend a training course		x		
Ask a community of practice		x		
Ask a social network				

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

  a) Yes we do through Social network Analysis Charts
  b) Yes we do through Organizational charts
  c) Other
  d) Don't Know-not done

> Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching		x			
Use quality circles to share sustainable oriented knowledge	x				
Utilize brainstorming techniques		x			
Write case notes on successful and unsuccessful processes	x				
Lessons learned systems			x		
Communities of practice		x			
Workshops			x		
Email				x	
Peer assist			x		
Training		x			

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

f) <u>Never</u>
g) Seldom
h) Usually
i) Always
j) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

    a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
    b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
    c) <u>Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.</u>
    d) Other
    e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

a) **<u>Verbally at team meetings</u>**
b) Written instructions
c) Ad- hoc verbally
d) **<u>Intranet</u>**
e) Video
f) Training
g) **<u>Mentoring</u>**
h) on the job training
i) Communities of practice
j) Don't know
k) Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
b) Is rare within the suitability department. Only a few projects will learn from others before they start.
c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
d) **<u>Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon</u>**
e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) Happens some of the time within the suitability department. It is applied in certain tasks.
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
e) **<u>Don't Know</u>**

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) Is rare within the sustainability department
c) Happens some of the time within the sustainability team. It is applied in certain tasks.
d) **Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.**
e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) **Don't know who to share with**
h) **Don't know what to share**
i) Don't Know
j) Other:

Comments:

Section D: Knowledge Acquisition and Application

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) **Yes**
b) No
c) Don't Know
d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x		
Operations staff has the information they need, when they need it		x			

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	x					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques		x				
Nobody challenge's the status quo	x					
Employees have to do things the official way, even if there is a better way of doing it		x				
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn			x			
Staff have complete freedom to learn from each other without					x	

management oversight					
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating			x		
Openness is valued in the organization				x	
People are willing to help each other and share information				x	
Employees feel as if a sense of belonging with the sustainability department is very weak.		x			

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
d) **Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share**
e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer			x		
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups			x		
Openness/Transparency - No hidden agendas				x	
Reward Structure: There is recognition for knowledge sharing with peers.		x			
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) **Lack of Time and meeting places**
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

> Comments: there exist no formal strategy on capturing knowledge

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm

b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) **Don't Know –not done**

> Comments: There is no KM roles within the firm

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) **Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.**
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

> Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
d) **Few people express that knowledge is significant to the firm.**

> Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) **Knowledge management is not linked to the business processes of the firm**

b) Knowledge management is loosely linked to the business processes of the firm
c) Some business areas or projects have defined critical Knowledge areas, which they manage
d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method
d) Result based management accountability framework (RMAF)
e) <u>Don't know-not done</u>
f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer. Once

Section A: Introduction - Knowledge Management

A1. Have you ever heard of the term knowledge management as a business strategy concept?

> Comments: Yes – Company E has been engaged on this topic by at least one other academic institution.

f) **Yes**   b) No

Section B: Knowledge Capture and /or Creation
Note: When we refer to "sustainable oriented Knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Social (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
c) Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d) Other:
g) Don't Know

> Comments: Generally speaking, thoughts and experiences are captured through various manners. Many employees are hired to fill a specific role based on their past experience – so they bring their thoughts into the role. Depending on the person and the role, there is also knowledge transfer through the sharing of information amongst team members, both vertically and horizontally (as in, colleague-to-colleague, or manager-employee). The Sustainability-related teams are lean in terms of resources – and therefore, one gap present is a lack of documentation around day-to-day job duties and tasks.

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) **Other**:

> Comments: Note that the options given above were not described and are left for respondents such as myself to interpret them – this may lead to inconsistency in responses.
>
> As noted above, one of the largest gaps internally is the lack of documented information. While this doesn't hinder the day-to-day completion of tasks, it introduces inefficiencies in terms of transferring knowledge to new employees. When information is documented, it is typically in the form of file notes, memos, or meeting minutes.
>
> Also note that one of the main roles of our head office is to provide guidance to our operations. As such, we create documents that guide our operations on what is expected of them as well as how to complete their objectives.

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

> Comments:
>
> Records are predominantly electronic, and are maintained on a company shared drive.
>
> In terms of knowledge sharing/guidance to our operations, we have a SharePoint site where documents can be posted.

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department

     c) Specific people in the sustainability department

     d) Don't Know

Comments: The shared drives have permissions limiting access.
The Sharepoint site that is used for file sharing with operations also has limited access, however, hundreds of employees have been given access, most of whom are outside of sustainability departments.

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm		x				
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			x			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing				x		
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.			x			
B9.We prevent loss of knowledge from retiring operations employees and other turnover					x	
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.		x				
B11. Our firm records and documents "Lessons Learned" on projects as a		x				

means of passing along the things that worked or did not work on a project.					
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.	x				

B13. How is the information from the capturing methods in Questions B5 to B8 held?

- a) Hard copies
- **b) Electronic copies**
- c) Central Electronic database (Company Intranet)
- d) No records held
- e) Don't Know
- f) Other:

> Comments: Electronic copies are kept, but they're typically the products themselves, and not necessarily documented the insights/how-to from past projects.

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

- a) Structured Interviews
- b) Knowledge Transfer Techniques
- **c) Other:**
- d) Don't Know

> Comments: Often, minimal knowledge transfer occurs from departing employees. On occasion, a week or two's overlap is present. In some cases, "departing" employees are simply changing roles or departments, and so their knowledge is still retained in the company for access.

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

- a) There is no sharing of knowledge through peer or social networks.
- b) Communities of practice (CoP) and knowledge-sharing networks are rare.
- c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
- **d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned**

e) Don't Know

> Comments: At company E, we have sustainability related departments, however, they're not named "Sustainability". Sustainability related topics – e.g. water, energy, biodiversity, communities – are natural business functions for our company, and have implications across all departments. We have "leads" for these areas at our operations as well as in our corporate office, as well as communities of practice linking our head office departments and our sites.

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research			x	
Look into the firms database		x		
Access Hard copy files		x		
Google		x		
Read a manual		x		
Attend a training course		x		
Ask a community of practice		x		
Ask a social network	x			

> Comments:

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

- a) Yes we do through Social network Analysis Charts
- b) Yes we do through Organizational charts
- **c) Other**
- d) Don't Know

> Comments: This occurs more typically through general conversation and interaction through our offices. While organizational charts are sometimes used, they are only a tool. Conversation/discussion amongst employees is the more common route for "mapping" the relationships for knowledge flows.

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know

Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge		x			
Utilize brainstorming techniques			x		
Write case notes on successful and unsuccessful processes		x			
Lessons learned systems			x		
Communities of practice			x		
Workshops			x		
Email			x		
Peer assist			x		
Training		x			

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

    a) Never
    b) Seldom
    c) Usually
    d) Always
    e) Don't Know

Comments: Conceptually, yes, this is the case. However, there are numerous examples where the sharing of knowledge doesn't lead to best practices, but the issue in that case isn't necessarily the poor sharing of information, as much as the limitations of an employee.

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

    a) None of the companies' key knowledge or   knowledge on how best to do things is stored or available for future re-use.
    b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
    c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
    d) Other
    e) Don't know

Comments: As noted previously, information is documented largely on an ad hoc basis, with the excepetion of guidance documents written/generated for the purposes of supporting our operations.

C7. How is sustainable oriented knowledge transferred within your firm?

    a) Verbally at team meetings
    b) Written instructions
    c) Ad- hoc verbally
    d) Intranet
    e) Video
    f) Training
    g) Mentoring
    h) on the job training
    i) Communities of practice
    j) Don't know
    k) Other:

Comments: All of the forums above are used to varying degrees within the company. Historically, most information was ad-hoc. Since the creation of company E's sustainability strategy in 2011, this increased focus and continuous focus has resulted in more documentation and use of communities of practices.

C8. How frequently does learning at the start of a new project occur?

    a) Never occurs within the suitability department. All new Projects are based on what the relevant staff already knows
    b) Is rare within the suitability department. Only a few projects will learn from others before they start.
    c) Happens some of the time within the suitability department. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
    e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the suitability department. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
e) Don't Know

> Comments: Within our departments, information sharing is excellent. However, given that the question refers to a "project", most project work in our company is focused on resource development projects, which pulls together team members from various departments. Given the various knowledge backgrounds and variety of projects, the discussion of learnings varies.

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the suitability department. The knowledge at the end of a project is never captured.
b) Is rare within the suitability department
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

> Comments: This is occurring in increasing fashion.

11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share

i) Don't Know
Other:

Comments: Generally, none of the ideas above are present at company E. When it comes to sustainability information – employees tend to work quite collaboratively. The biggest challenges are probably time limitations (employees have too much to do and don't have time to share) and geography(company E has multiple offices and operations, and employees don't necessarily interact with one another frequently across offices/operations)

Section D: Knowledge Acquisition and Application

D2. Does your firm have a system or tool to support;
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

Comments: SharePoint based Communities of Practice websites.

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

Comments: It is a common practice to learn from others work/leverage past experiences. We often also use a pilot approach model, wherein one site tests an approach, and if successful, is then shared with other sites.

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements				x	
Operations staff has the information			x		

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
they need, when they need it						

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions		x				
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques				x		
Nobody challenge's the status quo		x				
Employees have to do things the official way, even if there is a better way of doing it		x				
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn		x				
Staff have complete freedom to learn from each other without management oversight					x	
Staff in the sustainability division feel a sense of belonging				x		

and mangers are inspirational and motivating					
Openness is valued in the organization				x	
People are willing to help each other and share information				x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x				

E2. How is the nature of knowledge culture within the sustainability department of your firm?

    a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.

    b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.

    c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others

    d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share

    e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer			x		
Trust is prevalent in all	x				

interactions					
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas	x				
Reward Structure: There is recognition for knowledge sharing with peers.			x		
Organizational culture encourages innovation and continuous improvement		x			

E4. what do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

      a) Lack of Time and meeting places
      b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
      c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
      d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
      e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
      f) Others
      g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

      a) There are no defined knowledge Management roles in the sustainability department of the firm
      b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
      c) Knowledge roles are established in the sustainability department
      d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

    a) There is no technology available for creating, sharing or applying knowledge.
    b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
    c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
    d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
    e) There exist various technologies for all employees to capture, share and apply knowledge
    f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

    a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
    b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
    c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
    d) Few people express that knowledge is significant to the firm.

Comments: I would not say that we have a formal "strategy" around KM, although our management understands the value in sharing information and passing it onto new employees.

2.

How closely is KM linked to the business drivers and strategy of your firm?

    a) Knowledge management is not linked to the business processes of the firm
    b) Knowledge management is loosely linked to the business processes of the firm
    c) Some business areas or projects have defined critical Knowledge areas, which they manage

d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method
d) Result base management accountability framework (RMAF)
e) Don't know-not done
f) Other

Comments: I would say we don't monitor this.

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

i) **Yes**   b) No

Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)**
c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).**
d) **Other:**
e) Don't Know

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

    a) Cognitive maps
    b) Decision trees
    c) Frames
    d) Decision table
    e) Production rules
    f) Case Based reasoning
    g) Don't Know
    h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

    a) Hard copies
    b) Electronic copies
    c) Central Electronic database (Company Intranet)
    d) No records held
    e) Don't Know

Comments: we also have a data room

B4. Who has access to the information recoded in question B3?

    a) All employees
    b) Employees working in the sustainability department
    c) Specific people in the sustainability department
    d) Don't Know

Comments: The data room is restricted- specific personnel working in the sustainability department /individuals who have signed non-disclosure agreements

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm		x	x			

B6. We capture knowledge by observing other firms demonstration of techniques or procedures		x	x			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing		x	x			
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.		x	x			
B9.We prevent loss of knowledge from retiring operations employees and other turnover				x		
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.				x		
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.			x			
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.		x				

B13.How is the information from the capturing methods in Questions B5 to B8 held?

        a) Hard copies
        b) Electronic copies
        c) Central Electronic database (Company Intranet)
        d) No records held
        e) Don't Know
        f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

a) Structured Interviews
b) Knowledge Transfer Techniques
c) Other:
d) Don't Know

> Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

a) There is no sharing of knowledge through peer or social networks.
b) Communities of practice (CoP) and knowledge-sharing networks are rare.
c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
e) Don't Know

> Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges				x
Conduct their own research		x	x	
Look into the firms database			x	
Access Hard copy files		x		
Google		x	x	
Read a manual		x		
Attend a training course		x		
Ask a community of practice		x		
Ask a social network		x	x	

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

a) Yes we do through Social network Analysis Charts
b) Yes we do through Organizational charts

c) Other
d) Don't Know/not done

> Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge		x			
Utilize brainstorming techniques		x	x		
Write case notes on successful and unsuccessful processes	x				
Lessons learned systems		x			
Communities of practice		x			
Workshops			x		
Email			x		
Peer assist		x			
Training					

Other:

> Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

   a) Never
   b) Seldom
   c) Usually
   d) Always
   e) Don't Know

> Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

   a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
   b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.

c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.

d) Other

e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

a) Verbally at team meetings
b) Written instructions
c) Ad- hoc verbally
d) Intranet
e) Video
f) Training
g) Mentoring
h) on the job training
i) **Communities of practice**
j) Don't know
k) Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows

b) Is rare within the suitability department. Only a few projects will learn from others before they start.

c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine

d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon

e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.

b) Is rare within the suitability department.

c) Happens some of the time within the suitability department. It is applied in certain tasks.

d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.

e) Don't Know

> Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

   a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
   b) Is rare within the sustainability department
   c) Happens some of the time within the sustainability team. It is applied in certain tasks.
   d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
   e) Don't Know

> Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

   a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
   b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
   c) Organizational culture does not create a climate of trust
   d) conception that knowledge is property
   e) Don't know how to share
   f) Different Languages
   g) Don't know who to share with
   h) Don't know what to share
   i) Don't Know
   j) Other:

> Comments:

Section D: Knowledge Acquisition and Application

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

   a) Yes
   b) No
   c) Don't Know
   d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x	x	
Operations staff has the information they need, when they need it			x	x	

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	x					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques					x	
Nobody challenge's the status quo	x					
Employees have to do things the official way, even if there is a better way of doing it		x				
Personal learning within the sustainability department is subtly	x					

discouraged; 'we don't have time to learn						
Staff have complete freedom to learn from each other without management oversight				x		
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating					x	
Openness is valued in the organization					x	
People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

    a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
    b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
    c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
    d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
    e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer	x				
Trust is prevalent in all interactions	x				
There is communication and co-ordination between groups	x				
Openness/Transparency - No hidden agendas	x				
Reward Structure: There is recognition for knowledge sharing with peers.				x	
Organizational culture encourages innovation and continuous improvement	x				

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) Lack of Time and meeting places
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) **Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation**
d) **Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.**
e) **Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.**
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
d) Few people express that knowledge is significant to the firm.

Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) Some business areas or projects have defined critical Knowledge areas, which they manage
d) **Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.**
e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) **Benchmarking against industry practises**
b) **Balanced Score card method**
c) **House of Quality method**
d) **Result based management accountability framework (RMAF)**
e) Don't know
f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

f)   Yes   **b) No**

> Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a)   Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b)   Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
c)   Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d)   Other:
e)   Don't Know
f)

> Comments: There has been no structured effort to capture valuable thoughts and experiences of employees

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments: have not used any of these tools

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments:

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

Comments: no records are kept

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm		x				
B6. We capture knowledge by		x				

observing other firms demonstration of techniques or procedures						
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing		x				
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.	x					
B9.We prevent loss of knowledge from retiring operations employees and other turnover	x					
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.		x				
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.		x				
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.		x				

B13.How is the information from the capturing methods in Questions B5 to B8 held?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know
f) Other:

Comments: The firm has recently invested in Aconex software to track documents etc. in the development of our new Victoria project

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

a) Structured Interviews
b) Knowledge Transfer Techniques
c) Other:
d) Don't Know

Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

a) There is no sharing of knowledge through peer or social networks.
b) Communities of practice (CoP) and knowledge-sharing networks are rare.
c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research			x	
Look into the firms database		x		
Access Hard copy files		x		
Google			x	
Read a manual		x		
Attend a training course			x	
Ask a community of practice	x			
Ask a social network		x		

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

a) Yes we do through Social network Analysis Charts
b) Yes we do through Organizational charts
c) Other

d) Don't Know

Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge	x				
Utilize brainstorming techniques		x			
Write case notes on successful and unsuccessful processes		x			
Lessons learned systems	x				
Communities of practice	x				
Workshops	x				
Email		x			
Peer assist		x			
Training		x			

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

  a) Never
  b) Seldom
  c) Usually
  d) Always
  e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

  a) **None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.**
  b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
  c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.

d) Other
e) Don't know

```
Comments:
```

C7. How is sustainable oriented knowledge transferred within your firm?

a) **Verbally at team meetings**
b) Written instructions
c) **Ad- hoc verbally**
d) Intranet
e) Video
f) Training
g) Mentoring
h) on the job training
i) Communities of practice
j) Don't know
k) Other:

```
Comments:
```

C8. How frequently does learning at the start of a new project occur?

a) **Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows**
b) Is rare within the suitability department. Only a few projects will learn from others before they start.
c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
e) Don't Know

```
Comments:
```

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
e) Don't Know

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) Is rare within the sustainability department
c) Happens some of the time within the sustainability team. It is applied in certain tasks.
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) Other:

Comments:

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies
b) task support systems
c) personalization or profiling techniques
d) Don't Know
e) Other

Comments: do not use any of these techniques

D2. Does your firm have a system or tool to support;
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

Comments:

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements		x			
Operations staff has the information they need, when they need it		x			

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)

Employees don't feel trusted to make their own decisions		x				
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques					x	
Nobody challenge's the status quo			x			
Employees have to do things the official way, even if there is a better way of doing it			x			
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	x					
Staff have complete freedom to learn from each other without management oversight				x		
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x		
Openness is valued in the organization				x		
People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability			x			

department is very weak.						

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) **Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others**
d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
e) Don't Know

> Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer		x			
Trust is prevalent in all interactions			x		
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas			x		
Reward Structure: There is recognition for knowledge sharing with peers.		x			
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) **Lack of Time and meeting places**
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) **There are no defined knowledge Management roles in the sustainability department of the firm**
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) **Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.**
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

    a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this

    b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.

    c) There are ongoing discussions within the firm to try and develop a knowledge management strategy

    d) Few people express that knowledge is significant to the firm.

> Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

    a) Knowledge management is not linked to the business processes of the firm

    b) Knowledge management is loosely linked to the business processes of the firm

    c) Some business areas or projects have defined critical Knowledge areas, which they manage

    d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.

    e) Don't know

> Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

    a) Benchmarking against industry practises

    b) Balanced Score card method

    c) House of Quality method

    d) Result based management accountability framework (RMAF)

    e) Don't know

    f) Other

> Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction - Knowledge Management

A1. Have you ever heard of the term knowledge management as a business strategy concept?

g) Yes   **b) No**

> Comments:

Section B: Knowledge Capture and /or Creation
Note: When we refer to "sustainable oriented Knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector-specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
b) Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).**
d) Other:
e) Don't Know
f
> Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames

300

d) Decision table
e) Production rules
f) Case Based reasoning
g) **Don't Know**
h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) **Don't Know**

Comments:

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) **Don't Know**

Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm		x				"always "if this includes consultants
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			x			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing			x			

		x				
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.		x				
B9.We prevent loss of knowledge from retiring operations employees and other turnover			x			
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.			x			
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.				x		
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.			x			

B13.How is the information from the capturing methods in Questions B5 to B8 held?

a) **Hard copies**
b) **Electronic copies**
c) **Central Electronic database (Company Intranet)**
d) No records held
e) Don't Know
f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

a) Structured Interviews
b) Knowledge Transfer Techniques
c) Other:
d) **Don't Know**

Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

   a) There is no sharing of knowledge through peer or social networks.
   b) Communities of practice (CoP) and knowledge-sharing networks are rare.
   c) **Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department**
   d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
   e) Don't Know

   Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research			x	
Look into the firms database			x	
Access Hard copy files		x		
Google				x
Read a manual		x		
Attend a training course			x	
Ask a community of practice			x	
Ask a social network			x	

   Comments:

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

   a) Yes we do through Social network Analysis Charts
   b) **Yes we do through Organizational charts**
   c) Other
   d) Don't Know

   Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge	x				
Utilize brainstorming techniques		x			
Write case notes on successful and unsuccessful processes			x		
Lessons learned systems		x			
Communities of practice			x		
Workshops			x		
Email				x	
Peer assist		x			
Training			x		

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

    a) Never
    b) Seldom
    c) Usually
    d) Always
    e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

    a) None of the companies' key knowledge or   knowledge on how best to do things is stored or available for future re-use.
    b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
    c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
    d) Other
    e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

    a) **<u>Verbally at team meetings</u>**
    b) Written instructions
    c) **<u>Ad- hoc verbally</u>**
    d) **<u>Intranet</u>**
    e) Video
    f) Training
    g) Mentoring
    h) on the job training
    i) **<u>Communities of practice</u>**
    j) Don't know
    k) Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

    a) Never occurs within the suitability department. All new Projects are based on what the relevant staff already knows
    b) Is rare within the suitability department. Only a few projects will learn from others before they start.
    c) **<u>Happens some of the time within the suitability department. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine</u>**
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
    e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

    a) Never occurs within the suitability department. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
    b) Is rare within the suitability department.
    c) **<u>Happens some of the time within the suitability department. It is applied in certain tasks.</u>**
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
    e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the suitability department. The knowledge at the end of a project is never captured.
b) Is rare within the suitability department
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

> Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) **Other:**

> Comments: lack of time

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies
b) task support systems
c) personalization or profiling techniques
d) **Don't Know**
e) Other

> Comments:

D2. Does your firm have a system or tool to support;
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

```
Comments:
```

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

```
Comments:
```

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x		
Operations staff has the information they need, when they need it			x		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions		x				

Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques					x	
Nobody challenge's the status quo		x				
Employees have to do things the official way, even if there is a better way of doing it		x				
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn		x				
Staff have complete freedom to learn from each other without management oversight					x	
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x		
Openness is valued in the organization					x	
People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

 a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
 b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
 c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
 d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
 e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer		x			
Trust is prevalent in all interactions	x				
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas	x				
Reward Structure: There is recognition for knowledge sharing with peers.			x		
Organizational culture encourages innovation and continuous improvement		x			

E4. What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

 a) Lack of Time and meeting places

b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) <u>There are no defined knowledge Management roles in the sustainability department of the firm</u>
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) <u>There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.</u>
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

   a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
   b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
   c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
   d) Few people express that knowledge is significant to the firm.

   Comments:

2. How closely is KM linked to the business drivers and strategy of your firm?

   a) Knowledge management is not linked to the business processes of the firm
   b) Knowledge management is loosely linked to the business processes of the firm
   c) Some business areas or projects have defined critical Knowledge areas, which they manage
   d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
   e) Don't know

   Comments:

Section I: Knowledge Management Metrics

1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

   a) Benchmarking against industry practises
   b) Balanced Score card method
   c) House of Quality method
   d) Result base management accountability framework (RMAF)
   e) Don't know
   f) Other

   Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

   h)   Yes   **b) No**

> Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

   a)   Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
   b)   Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
   c)   **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are** understandable once an employee watches an expert do what he knows what to do).
   d)   Other:
   e)   Don't Know
   f

> Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments:

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm			x			
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			x			
B7.We capture Knowledge through experimental learning i.e knowledge	x					

that is created by doing and practicing					
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.	x				
B9.We prevent loss of knowledge from retiring operations employees and other turnover	x				
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.		x			
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.		x			
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.	x				

B13.How is the information from the capturing methods in Questions B5 to B8 held?

        a) Hard copies
        b) Electronic copies
        c) Central Electronic database (Company Intranet)
        d) No records held
        e) Don't Know
        f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

        a) Structured Interviews
        b) Knowledge Transfer Techniques
        c) Other:
        d) Don't Know

	Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

- a) There is no sharing of knowledge through peer or social networks.
- b) Communities of practice (CoP) and knowledge-sharing networks are rare.
- c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
- **d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned**
- e) Don't Know

Comments:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

- a) Yes we do through Social network Analysis Charts
- b) Yes we do through Organizational charts
- c) Other
- **d) Don't Know- not done**

Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge	x				
Utilize brainstorming techniques	x				
Write case notes on successful and unsuccessful processes	x	x			
Lessons learned systems	x				
Communities of practice		x			
Workshops		x			
Email			x		
Peer assist			x		

Training			x		

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

    a) Never
    b) Seldom
    c) Usually
    d) Always
    e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

    a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
    b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
    c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
    d) Other
    e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

    a) Verbally at team meetings
    b) Written instructions
    c) Ad- hoc verbally
    d) Intranet
    e) Video
    f) Training
    g) Mentoring
    h) on the job training
    i) Communities of practice
    j) Don't know
    k) Other:

```
┌─────────────────────────────────────────────────────────────┐
│ Comments:                                                   │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

C8. How frequently does learning at the start of a new project occur?

    a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows

    b) Is rare within the suitability department. Only a few projects will learn from others before they start.

    c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine

    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon

    e) Don't Know

```
┌─────────────────────────────────────────────────────────────┐
│ Comments:                                                   │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

C9. How frequently do teams discuss their own learning during a project?

    a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.

    b) Is rare within the suitability department.

    c) **Happens some of the time within the suitability department. It is applied in certain tasks**.

    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.

    e) Don't Know

```
┌─────────────────────────────────────────────────────────────┐
│ Comments:                                                   │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

    a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.

    b) Is rare within the sustainability department

    c) Happens some of the time within the sustainability team. It is applied in certain tasks.

    d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.

    e) Don't Know

```
┌─────────────────────────────────────────────────────────────┐
│ Comments:                                                   │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) Other:

> Comments: effective communication

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies
b) task support systems
c) personalization or profiling techniques
d) Don't Know
e) Other

> Comments:

D2. Does your firm have a system or tool to support;
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

> Comments:

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No

c) Don't Know
d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x		
Operations staff has the information they need, when they need it			x		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	x					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques				x		
Nobody challenge's the status quo			x			
Employees have to do things the official way, even if there is a better way of doing it			x			Time does not always allow discussion for improvements
Personal learning within the		x				

319

sustainability department is subtly discouraged; 'we don't have time to learn					
Staff have complete freedom to learn from each other without management oversight				x	
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x	
Openness is valued in the organization				x	
People are willing to help each other and share information				x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x				

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
d) **Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share**
e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer	x				
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas	x				
Reward Structure: There is recognition for knowledge sharing with peers.		x			
Organizational culture encourages innovation and continuous improvement	x				

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

   a) Lack of Time and meeting places
   b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
   c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
   d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
   e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
   f) Others
   g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

   a) There are no defined knowledge Management roles in the sustainability department of the firm
   b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
   c) Knowledge roles are established in the sustainability department
   d) Don't Know –not done

   Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

   a) There is no technology available for creating, sharing or applying knowledge.
   b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
   c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
   d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
   e) There exist various technologies for all employees to capture, share and apply knowledge
   f) Don't Know

   Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

   a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
   b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
   c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
   d) Few people express that knowledge is significant to the firm.

   Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) Some business areas or projects have defined critical Knowledge areas, which they manage
d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method
d) Result based management accountability framework (RMAF)
e) Don't know-not done
f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction - Knowledge Management

A1. Have you ever heard of the term knowledge management as a business strategy concept?

i)   Yes X   b) No

Comments:

Section B: Knowledge Capture and /or Creation
Note: When we refer to "sustainable oriented Knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector-specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

   a) Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)
   b) Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)
   c) Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
   d) **Other**:
   e) Don't Know
   f

Comments: ***Ad hoc – resides with the knowledge holder. No formal process inplace for knowledge capture.***

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

   a) Cognitive maps
   b) Decision trees
   c) Frames
   d) Decision table

e) Production rules
f) Case Based reasoning
g) Don't Know
h) **Other**:

> Comments: **lessons learned sometimes captured. "After Action Reviews" becoming more common.**

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

> Comments:

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

> Comments: **Depends upon the access set up when the file is saved to the EDMS.**

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm			**X**			
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			**X**			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing	**X**					

B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.		X				
B9.We prevent loss of knowledge from retiring operations employees and other turnover	X					
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.		X				
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.			X			
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.				X		

B13.How is the information from the capturing methods in Questions B5 to B8 held?

       a) Hard copies
       b) Electronic copies
       c) Central Electronic database (Company Intranet)
       d) No records held
       e) Don't Know
       f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

       a) Structured Interviews
       b) Knowledge Transfer Techniques
       c) Other:
       d) Don't Know

Comments: **Infrequent knowledge capture or exit interviews.**

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

a) There is no sharing of knowledge through peer or social networks.
b) Communities of practice (CoP) and knowledge-sharing networks are rare.
c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			X	
Conduct their own research			X	
Look into the firms database			X	
Access Hard copy files	X			
Google			X	
Read a manual			X	
Attend a training course			X	
Ask a community of practice			X	
Ask a social network			X	

Comments:

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

a) Yes we do through Social network Analysis Charts
b) Yes we do through Organizational charts
c) Other
d) Don't Know

Comments: **Not done.**

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching		X			
Use quality circles to share sustainable oriented knowledge	X				
Utilize brainstorming techniques			X		
Write case notes on successful and unsuccessful processes		X			
Lessons learned systems			X		
Communities of practice			X		
Workshops		X			
Email			X		
Peer assist		X			
Training		X			

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

a) Never
b) Seldom
c) Usually
d) Always
e) Don't Know

Comments: **Depends upon which area: Safety Always, Environment and communities sometimes, health rarely.**

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
b) **Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.**
c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
d) Other
e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

    a) Verbally at team meetings
    b) Written instructions
    c) Ad- hoc verbally
    d) Intranet
    e) Video
    f) Training
    g) Mentoring
    h) on the job training
    i) Communities of practice
    j) Don't know
    k) Other:

> Comments:

C8. How frequently does learning at the start of a new project occur?

    a) Never occurs within the suitability department. All new Projects are based on what the relevant staff already knows
    b) Is rare within the suitability department. Only a few projects will learn from others before they start.
    c) Happens some of the time within the sustainability ~~suitability~~ department. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
    e) Don't Know

> Comments:

C9. How frequently do teams discuss their own learning during a project?

    a) Never occurs within the suitability department. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
    b) Is rare within the suitability department.
    c) Happens some of the time within the suitability department. It is applied in certain tasks.
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
    e) Don't Know

> Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the suitability department. The knowledge at the end of a project is never captured.
b) Is rare within the suitability department
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

Comments:

11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) **Other:**

Comments: **Absence of formal knowledge capture/transfer system**

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies
b) task support systems
c) personalization or profiling techniques
d) **Don't Know**
e) Other

Comments:

D2. Does your firm have a system or tool to support;
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge

- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

> Comments:

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

> Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			X		
Operations staff has the information they need, when they need it			X		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions	X					

Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques					X	
Nobody challenge's the status quo	X					
Employees have to do things the official way, even if there is a better way of doing it	X					
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	X					
Staff have complete freedom to learn from each other without management oversight					X	
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				X		
Openness is valued in the organization					X	
People are willing to help each other and share information					X	
Employees feel as if a sense of belonging with the sustainability department is very weak.	X					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
d) **Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share**
e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer	X				
Trust is prevalent in all interactions	X				
There is communication and co-ordination between groups	X				
Openness/Transparency - No hidden agendas	X				
Reward Structure: There is recognition for knowledge sharing with peers.	X				
Organizational culture encourages innovation and continuous improvement	X				

E4. If your firm does not have a Knowledge sharing culture, what do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) **Lack of Time and meeting places**

b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
d) Few people express that knowledge is significant to the firm.

Comments:

2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) Some business areas or projects have defined critical Knowledge areas, which they manage
d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method
d) Result base management accountability framework (RMAF)
e) Don't know
f) Other

Comments: **Not monitored**

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

j) **Yes**   b) No

Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) **Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)**
b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge**)
c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are** understandable once an employee watches an expert do what he knows what to do).
d) Other:
e) Don't Know

Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments: share drive/Borealis/MS

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the			x			

firm						
B6. We capture knowledge by observing other firms demonstration of techniques or procedures		x				
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing		x				
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.			x			
B9.We prevent loss of knowledge from retiring operations employees and other turnover		x				
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.			x			
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.			x			
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.		x				

B13.How is the information from the capturing methods in Questions B5 to B8 held?

      a) Hard copies
      b) Electronic copies
      c) Central Electronic database (Company Intranet)
      d) No records held
      e) Don't Know
      f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

   a) Structured Interviews
   b) Knowledge Transfer Techniques
   c) Other:
   d) Don't Know-not done

Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

   a) There is no sharing of knowledge through peer or social networks.
   b) Communities of practice (CoP) and knowledge-sharing networks are rare.
   c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
   d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
   e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges			x	
Conduct their own research			x	
Look into the firms database		x		
Access Hard copy files		x		
Google			x	
Read a manual			x	
Attend a training course		x		
Ask a community of practice			x	
Ask a social network	x			

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

    a) Yes we do through Social network Analysis Charts
    b) Yes we do through Organizational charts
    c) Other
    d) Don't Know

> Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge			x		
Utilize brainstorming techniques				x	
Write case notes on successful and unsuccessful processes		x			
Lessons learned systems		x			
Communities of practice					x
Workshops					x
Email					x
Peer assist					x
Training				x	

Other:

> Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

    a) Never
    b) Seldom
    c) Usually
    d) Always
    e) Don't Know

> Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
d) Other
e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

a) Verbally at team meetings
b) Written instructions
c) Ad- hoc verbally
d) **Intranet**
e) Video
f) Training
g) Mentoring
h) on the job training
i) Communities of practice
j) Don't know
k) Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
b) Is rare within the suitability department. Only a few projects will learn from others before they start.
c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.

c) Happens some of the time within the suitability department. It is applied in certain tasks.

d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.

e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.

b) Is rare within the sustainability department

c) Happens some of the time within the sustainability team. It is applied in certain tasks.

d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.

e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share

b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.

c) Organizational culture does not create a climate of trust

d) conception that knowledge is property

e) Don't know how to share

f) Different Languages

g) Don't know who to share with

h) Don't know what to share

i) Don't Know

j) Other:

Comments: lack of systems to support sharing

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies

b) task support systems
c) personalization or profiling techniques
d) Don't Know
e) Other

Comments:

D2. Does your firm have a system or tool to support;
- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

Comments:

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x		
Operations staff has the information they need, when they need it			x		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions		x				
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques		x				
Nobody challenge's the status quo		x				
Employees have to do things the official way, even if there is a better way of doing it			x			
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn		x				
Staff have complete freedom to learn from each other without management oversight				x		
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x		
Openness is valued in the organization			x			

People are willing to help each other and share information					x	
Employees feel as if a sense of belonging with the sustainability department is very weak.	x					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

    a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
    b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
    c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others
    d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
    e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer			x		
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups	x				
Openness/Transparency - No hidden agendas		x			
Reward Structure: There is recognition for knowledge sharing with peers.				x	
Organizational culture		x			

encourages innovation and continuous improvement					

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) **Lack of Time and meeting places**
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) **Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation**
d) **Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.**
e) **Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.**
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) **Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).**
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) **Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.**
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.

d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
c) **There are ongoing discussions within the firm to try and develop a knowledge management strategy**
d) Few people express that knowledge is significant to the firm.

Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) **Some business areas or projects have defined critical Knowledge areas, which they manage**
d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method

d) Result based management accountability framework (RMAF)
e) Don't know-not done
f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

k)   Yes   **b) No**

Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) **Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)**
b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)**
c) Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).
d) Other:
e) Don't Know

Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

> Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

> Comments:

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

> Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm				x		
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			x			

B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing			x			
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.				x		
B9.We prevent loss of knowledge from retiring operations employees and other turnover				x		
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.			x			
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.		x				
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.			x			

B13.How is the information from the capturing methods in Questions B5 to B8 held?

      a) Hard copies
      b) Electronic copies
      c) Central Electronic database (Company Intranet)
      d) No records held
      e) Don't Know
      f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

      a) Structured Interviews
      b) Knowledge Transfer Techniques
      c) Other:

d) Don't Know

Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

   a) There is no sharing of knowledge through peer or social networks.
   b) Communities of practice (CoP) and knowledge-sharing networks are rare.
   c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
   d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
   e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges				x
Conduct their own research			x	
Look into the firms database			x	
Access Hard copy files		x		
Google				x
Read a manual			x	
Attend a training course			x	
Ask a community of practice				x
Ask a social network				x

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

   a) Yes we do through Social network Analysis Charts
   b) Yes we do through Organizational charts
   c) Other
   d) Don't Know-not done

Comments: No

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching		X			
Use quality circles to share sustainable oriented knowledge			X		
Utilize brainstorming techniques			X		
Write case notes on successful and unsuccessful processes				X	
Lessons learned systems		X			
Communities of practice				X	
Workshops				X	
Email				X	
Peer assist				X	
Training			X		

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

   a) Never
   b) Seldom
   c) Usually
   d) Always
   e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

   a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
   b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
   c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
   d) Other
   e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

a) Verbally at team meetings
b) **Written instructions**
c) Ad- hoc verbally
d) **Intranet**
e) Video
f) **Training**
g) Mentoring
h) on the job training
i) **Communities of practice**
j) Don't know
k) Other:

> Comments:

C8. How frequently does learning at the start of a new project occur?

a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
b) Is rare within the suitability department. Only a few projects will learn from others before they start.
c) **Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine**
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
e) Don't Know

> Comments:

C9. How frequently do teams discuss their own learning during a project?

a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
b) Is rare within the suitability department.
c) **Happens some of the time within the suitability department. It is applied in certain tasks.**
d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
e) Don't Know

> Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

    a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
    b) Is rare within the sustainability department
    c) Happens some of the time within the sustainability team. It is applied in certain tasks.
    d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
    e) Don't Know

> Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

    a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
    b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
    c) Organizational culture does not create a climate of trust
    d) conception that knowledge is property
    e) Don't know how to share
    f) Different Languages
    g) Don't know who to share with
    h) Don't know what to share
    i) Don't Know
    j) Other:

> Comments:

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

    a) learning taxonomies
    b) task support systems
    c) personalization or profiling techniques
    d) Don't Know
    e) Other

> Comments:

D2. Does your firm have a system or tool to support;
    - Communication amongst various users

- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) Yes
b) No
c) Don't Know
d) Other

> Comments:

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) Yes
b) No
c) Don't Know
d) Other:

> Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements				x	
Operations staff has the information they need, when they need it				x	

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their own decisions				x		

Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques				x		
Nobody challenge's the status quo		x				
Employees have to do things the official way, even if there is a better way of doing it			x			
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	x					
Staff have complete freedom to learn from each other without management oversight					x	
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x		
Openness is valued in the organization				x		
People are willing to help each other and share information			x			
Employees feel as if a sense of belonging with the sustainability department is very weak.		x				

357

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) **Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others**
d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer	x				
Trust is prevalent in all interactions		x			
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas			x		
Reward Structure: There is recognition for knowledge sharing with peers.				x	
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) **Lack of Time and meeting places**

b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

   a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
   b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
   c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
   d) Few people express that knowledge is significant to the firm.

   Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

   a) Knowledge management is not linked to the business processes of the firm
   b) Knowledge management is loosely linked to the business processes of the firm
   c) Some business areas or projects have defined critical Knowledge areas, which they manage
   d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
   e) Don't know

   Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

   a) Benchmarking against industry practises
   b) Balanced Score card method
   c) House of Quality method
   d) Result based management accountability framework (RMAF)
   e) Don't know- not done
   f) Other

   Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction – Knowledge Management

In this study when we are referring to "knowledge management", we are referring to the deliberate and systematic co-ordination of an organizations people, technology, processes, and organizational structure in order to add value through re-use and innovation. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continual organizational learning

A1. Have you ever heard of the term knowledge management as a business strategy concept?

l) **Yes**   b) No

Comments:

Section B: Knowledge Capture and /or Creation

In this study, when we refer to "sustainability knowledge", we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector- specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

a) **Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)**
b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)**
c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).**
d) Other:
e) Don't Know

Comments:

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

a) Cognitive maps
b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments:

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm			x			
B6. We capture knowledge by			x			

Statement						Comments
observing other firms demonstration of techniques or procedures						
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing				x		
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.			x			
B9.We prevent loss of knowledge from retiring operations employees and other turnover			x			
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.		x				We don't do it well enough
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.		x				We don't do it well enough
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.		x				

B13.How is the information from the capturing methods in Questions B5 to B8 held?

a) **Hard copies**
b) **Electronic copies**
c) **Central Electronic database (Company Intranet)**
d) No records held
e) Don't Know
f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

a) Structured Interviews
b) Knowledge Transfer Techniques
c) Other:
d) Don't Know

Comments:

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

a) There is no sharing of knowledge through peer or social networks.
b) Communities of practice (CoP) and knowledge-sharing networks are rare.
c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges				x
Conduct their own research			x	
Look into the firms database			x	
Access Hard copy files			x	
Google			x	
Read a manual			x	
Attend a training course		x		
Ask a community of practice		x		
Ask a social network		x		

Other: internal/external communications

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

a) Yes we do through Social network Analysis Charts
b) Yes we do through Organizational charts
c) Other

d) Don't Know

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			x		
Use quality circles to share sustainable oriented knowledge	x				
Utilize brainstorming techniques			x		
Write case notes on successful and unsuccessful processes		x			
Lessons learned systems		x			
Communities of practice		x			
Workshops			x		
Email			x		
Peer assist			x		
Training					

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

a) Never
b) Seldom
c) Usually
d) Always
e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
d) Other
e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

   a) Verbally at team meetings
   b) Written instructions
   c) Ad- hoc verbally
   d) Intranet
   e) Video
   f) Training
   g) Mentoring
   h) on the job training
   i) Communities of practice
   j) Don't know
   k) Other:

Comments:

C8. How frequently does learning at the start of a new project occur?

   a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
   b) Is rare within the suitability department. Only a few projects will learn from others before they start.
   c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
   d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
   e) Don't Know

Comments:

C9. How frequently do teams discuss their own learning during a project?

   a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
   b) Is rare within the suitability department.
   c) Happens some of the time within the suitability department. It is applied in certain tasks.
   d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
   e) Don't Know

Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) Is rare within the sustainability department
c) Happens some of the time within the sustainability team. It is applied in certain tasks.
d) Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.
e) Don't Know

> Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) Organizational culture does not create a climate of trust
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) Other:

> Comments: lack of time

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) learning taxonomies
b) task support systems
c) personalization or profiling techniques
d) Don't Know
e) Other

> Comments:

D2. Does your firm have a system or tool to support;

- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) **Yes**
b) No
c) Don't Know
d) Other

Comments: share point system called "conveyor"

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) **Yes**
b) No
c) Don't Know
d) Other:

Comments:

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements			x		
Operations staff has the information they need, when they need it			x		

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make		x				

their own decisions					
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques				x	
Nobody challenge's the status quo		x			
Employees have to do things the official way, even if there is a better way of doing it		x			
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn		x			
Staff have complete freedom to learn from each other without management oversight					x
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating				x	
Openness is valued in the organization					x
People are willing to help each other and share information				x	
Employees feel as if a sense of belonging with the sustainability department is very		x			

weak.						

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.
b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.
c) **Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others**
d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share
e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer		x			
Trust is prevalent in all interactions	x				
There is communication and co-ordination between groups		x			
Openness/Transparency - No hidden agendas		x			
Reward Structure: There is recognition for knowledge sharing with peers.			x		
Organizational culture encourages innovation and continuous improvement		x			

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) Lack of Time and meeting places
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.
c) Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation
d) Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.
e) Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.
f) Others
g) Don't Know

Comments:

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).
c) Knowledge roles are established in the sustainability department
d) Don't Know

Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) There exist various technologies for all employees to capture, share and apply knowledge
f) Don't Know

Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
b) A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.
c) **There are ongoing discussions within the firm to try and develop a knowledge management strategy**
d) Few people express that knowledge is significant to the firm.

Comments:

H2. How closely is KM linked to the business drivers and strategy of your firm?

a) Knowledge management is not linked to the business processes of the firm
b) Knowledge management is loosely linked to the business processes of the firm
c) **Some business areas or projects have defined critical Knowledge areas, which they manage**
d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
e) Don't know

Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

a) Benchmarking against industry practises
b) Balanced Score card method
c) House of Quality method
d) Result based management accountability framework (RMAF)
e) **Don't know- not done**
f) Other

Comments:

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction - Knowledge Management

A1. Have you ever heard of the term knowledge management as a business strategy concept?

    f)   **Yes**   b) No

> Comments: **KM is about capturing, developing, sharing and making effective use of a company's knowledge or using multiple approaches to achieve organizational goals by employing the best of knowledge.**

Section B: Knowledge Capture and /or Creation

Note: When we refer to "sustainable oriented Knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector-specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

    a) **Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)**
    b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)**
    c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).**
    d) Other:
    e) Don't Know
    f

> Comments: **Video Coverage, Brainstorming and minutes writing at community meetings**

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

    a) **Cognitive maps**

b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

Comments:

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) Hard copies
b) Electronic copies
c) Central Electronic database (Company Intranet)
d) No records held
e) Don't Know

Comments: **Existing Common Domain/Drive are accessible by members only.**

B4. Who has access to the information recoded in question B3?

a) All employees
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

Comments: **For confidentiality purpose, certain information cannot be accessed by contractors**

B5-B9 (B5-B12). Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm		X				
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			X			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and practicing			X			

Statement						
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.				X		
B9.We prevent loss of knowledge from retiring operations employees and other turnover				X		
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.				X		
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.				X		
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.				X		

B13.How is the information from the capturing methods in Questions B5 to B8 held?

    a) Hard copies
    b) Electronic copies
    c) Central Electronic database (Company Intranet)
    d) No records held
    e) Don't Know
    f) Other:

> Comments: **Departmental Common Drive**

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

    a) Structured Interviews
    b) Knowledge Transfer Techniques
    c) Other:
    d) Don't Know

> Comments: **Departing employees complete Exit Clearance Form and Exit Interviews.**

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

   a) There is no sharing of knowledge through peer or social networks.
   b) Communities of practice (CoP) and knowledge-sharing networks are rare.
   c) Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department
   d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
   e) Don't Know

Comments:

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always
Have a discussion with other colleges				X
Conduct their own research			X	
Look into the firms database				X
Access Hard copy files				X
Google			X	
Read a manual				X
Attend a training course			X	
Ask a community of practice				X
Ask a social network			X	

Comments:

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

   a) Yes we do through Social network Analysis Charts
   b) Yes we do through Organizational charts
   c) Other
   d) Don't Know

Comments:

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching				X	
Use quality circles to share sustainable oriented knowledge				X	
Utilize brainstorming techniques			X		
Write case notes on successful and unsuccessful processes			X		
Lessons learned systems				X	
Communities of practice				X	
Workshops			X		
Email				X	
Peer assist			X		
Training			X		

Other:

Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

a) Never
b) Seldom
c) Usually
d) Always
e) Don't Know

Comments:

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
b) Key knowledge is collected and made available to a small portion of staff in the sustainability Department. The key knowledge is however not routinely updated.
c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
d) Other
e) Don't know

Comments:

C7. How is sustainable oriented knowledge transferred within your firm?

    a) Verbally at team meetings
    b) Written instructions
    c) Ad- hoc verbally
    d) Intranet
    e) Video
    f) Training
    g) Mentoring
    h) on the job training
    i) Communities of practice
    j) Don't know
    k) Other:

> Comments: **Knowledge broker, knowledge repositories (database), master – apprentices relationship, information sharing forums and expert directories.**

C8. How frequently does learning at the start of a new project occur?

    a) Never occurs within the sustainability team. All new Projects are based on what the relevant staff already knows
    b) Is rare within the suitability department. Only a few projects will learn from others before they start.
    c) Happens some of the time within the sustainability team. It occurs on an ad hoc basis, It is neither unknown behaviour nor is it routine
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon
    e) Don't Know

> Comments:

C9. How frequently do teams discuss their own learning during a project?

    a) Never occurs within the sustainability team. Project team and Project managers discuss about task delivery but not about Knowledge or learning.
    b) Is rare within the suitability department.
    c) Happens some of the time within the suitability department. It is applied in certain tasks.
    d) Happens all the time and occurs as routine for all Projects. Any knowledge that is acquired is acted upon and forward plans in the project are updated as a result.
    e) Don't Know

> Comments:

C10. How frequently do teams review what happened in the end of a project in order capture and document new knowledge to share with others?

a) Never occurs within the sustainability team. The knowledge at the end of a project is never captured.
b) Is rare within the sustainability department
c) Happens some of the time within the sustainability team. It is applied in certain tasks.
d) **Happens all the time and occurs as routine for all Projects. Knowledge at the end of the Project leads to lessons learned which will improve the way work is done in the future.**
e) Don't Know

Comments:

C11. What does your firm consider to be an obstacle in knowledge sharing within the sustainability department or sustainability projects?

a) Notion that knowledge is power, i.e. individuals feels as if they ought not to share because they are rewarded for what they know and not what they share
b) The Knowledge provider is unsure that the receiver will understand and correctly use the knowledge or the recipient is unsure of the credibility of the knowledge in question.
c) **Organizational culture does not create a climate of trust**
d) conception that knowledge is property
e) Don't know how to share
f) Different Languages
g) Don't know who to share with
h) Don't know what to share
i) Don't Know
j) Other:

Comments: **Top-Down Approach sometimes inhibits subordinate employees to access the knowledge**

Section D: Knowledge Acquisition and Application

D1. What methods does your firm use to ensure that best possible match between user needs and the content that is applied?

a) **learning taxonomies**
b) **task support systems**
c) **personalization or profiling techniques**
d) Don't Know
e) Other

Comments:

D2. Does your firm have a system or tool to support;

- Communication amongst various users
- Coordination of user activities
- Collaboration amongst user groups and the creation, modification and dissemination of Knowledge
- Control process to ensure integrity and track the progress of projects

a) **Yes**
b) No
c) Don't Know
d) Other

Comments:

D3. Does your firm encourage employees to reuse knowledge to increase efficiency and effectiveness as opposed to re-inventing what has been developed or solved?

a) **Yes**
b) No
c) Don't Know
d) Other:

Comments: **Innovations adding up to efficiency and effectiveness are welcome**

D4.Please rate your current organizational effectiveness in the following knowledge management components. Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Operations staff has the knowledge, abilities and behaviors necessary to do the job today and meet future requirements				X	
Operations staff has the information they need, when they need it				X	

Section E: Organizational Culture

E1. The chart below seeks to understand the various types of organizational culture present within the sustainability department of the mining firms. Please put an (X) mark inside the box that corresponds to your answer.

	Strongly disagree	Moderately disagree	Slightly Disagree	Moderately agree	Strongly agree	Comments (If necessary)
Employees don't feel trusted to make their				X		

own decisions						
Members are expected to meet the company goals and get the job done quickly. Thus there is no room for political cliques					X	
Nobody challenge's the status quo					X	
Employees have to do things the official way, even if there is a better way of doing it					X	
Personal learning within the sustainability department is subtly discouraged; 'we don't have time to learn	X					
Staff have complete freedom to learn from each other without management oversight					X	
Staff in the sustainability division feel a sense of belonging and mangers are inspirational and motivating					X	
Openness is valued in the organization				X		
People are willing to help each other and share information				X		
Employees feel as if a sense of belonging with the sustainability department is very weak.	X					

E2. How is the nature of knowledge culture within the sustainability department of your firm?

a) The behaviours and the attitudes of the management and employees are not supportive to knowledge sharing. There is internal competition within the organisation.

b) There are some few people who are open to sharing and reusing knowledge across the organisation. However the default behaviour is still hoarding, internal competition and reinvention of solutions.

c) Knowledge sharing and learning from others is neutral behaviour. It is neither seen as desirable nor undesirable. It occurs in some areas of the organization, but not others

d) Knowledge sharing is the norm in our organizations culture. Knowledge is something people feel they should share

e) Don't Know

Comments:

E3. Please rate the importance of these knowledge management issues to your firm. Put an (X) mark inside the box that corresponds to your answer.

	Very important	Important	Somewhat Important	Not important	Don't know
Top management allocates resources to support knowledge transfer	X				
Trust is prevalent in all interactions	X				
There is communication and co-ordination between groups	X				
Openness/Transparency - No hidden agendas	X				
Reward Structure: There is recognition for knowledge sharing with peers.	X				
Organizational culture encourages innovation and continuous improvement	X				

E4 What do you feel are the barriers to a cultural change needed for Knowledge Management to succeed?

a) Lack of Time and meeting places
b) Rewarding of knowledge hoarding I.e. performance appraisals and promotions are rewarded by being the first and only one who has thought of an idea. Thus the enhancement of career prospects impedes knowledge sharing.

c) **Lack of absorptive capacity. i.e. lack of an individual or organizations ability to be open to change and innovation**
d) **Intolerance for mistakes. I.e. firms expects employees to know all the answers to questions and asking someone for assistance implies that one is not qualified for the job.**
e) **Lack of common language i.e. Jargon or shared technical or professional languages that can cause a great deal of confusion.**
f) Others
g) Don't Know

> Comments: **Lack of mutual trust and confidence**

Section F: Knowledge Management Team

F1. Are there any Knowledge Management roles laid out in the sustainability department of your firm?

a) There are no defined knowledge Management roles in the sustainability department of the firm
b) **Some Knowledge roles are laid out within the sustainability department (for example CoP leaders, CoP facilitators, Knowledge brokers).**
c) **Knowledge roles are established in the sustainability department**
d) Don't Know

> Comments:

Section G: Knowledge Management Tools and Technologies

G1. Are there any technologies to support the management of sustainable oriented knowledge within your firm?

a) There is no technology available for creating, sharing or applying knowledge.
b) Some limited technology infrastructure exists, such as search engine and email, but nothing for effective collaboration, networking or sharing.
c) **There is a general infrastructure of supportive technologies, covering search, collaboration and knowledge organisation, but it is by no means easy or possible to share or find knowledge across the entire firm.**
d) The technology infrastructure largely supports KM but some barriers still exist for effective networking, publishing and finding published knowledge, or finding knowledgeable people
e) **There exist various technologies for all employees to capture, share and apply knowledge**
f) Don't Know

> Comments:

Section H: Knowledge Management Strategy

H1. Please select the appropriate criteria with respect to the Knowledge management strategy of your firm

   a) Knowledge and learning are very important to the organizations strategy. There exist various technologies for all employees to capture, share and apply knowledge and the organizations culture supports this
   b) **A knowledge management strategy does exist in our firm, but it is not integrated with overall goals of the firm.**
   c) There are ongoing discussions within the firm to try and develop a knowledge management strategy
   d) Few people express that knowledge is significant to the firm.

> Comments:
> **Codification – collected, encoded, stored and accessible by all.**
> **Personalization – direct sharing of knowledge with other employees.**
> **Reward – linked into performance measurement**
> **After-action-reviews**

H2. How closely is KM linked to the business drivers and strategy of your firm?

   a) Knowledge management is not linked to the business processes of the firm
   b) Knowledge management is loosely linked to the business processes of the firm
   c) **Some business areas or projects have defined critical Knowledge areas, which they manage**
   d) Knowledge management is fully fixed into the business processes. i.e majority or all departments and projects focus on knowledge critical to them, and all areas of strategic knowledge are managed.
   e) Don't know

> Comments:

Section I: Knowledge Management Metrics

I1. How does your firm monitor how well KM is succeeding and how well it has helped attain organizational goals?

   a) **Benchmarking against industry practises**
   b) Balanced Score card method
   c) House of Quality method
   d) **Result based management accountability framework (RMAF)**
   e) Don't know
   f) Other

> Comments: **Employees' Performance Appraisal**

On the following pages are questions about Knowledge Management practices. Knowledge management may be unfamiliar to you, and there are no right or wrong answers, so please be as honest as possible. If you feel the need to comment on a question, feel free to do so.

INSTRUCTIONS: On multiple choice questions, please underline or bold the most appropriate answer

Section A: Introduction - Knowledge Management

A1. Have you ever heard of the term knowledge management as a business strategy concept?

g) **Yes**   b) No

> Comments:

Section B: Knowledge Capture and /or Creation
Note: When we refer to "sustainable oriented Knowledge" we are referring to knowledge concerning the three dimensions of sustainability, i.e. Environment (Biodiversity and land stewardship, climate change, water management, etc.), Economic (Profit cost saving, supply chain management, transparency and accountability, external performance indicators, sector-specific Global initiatives, etc.), Social (Worker and community safety, stakeholder engagement, policies for mine life cycle, human rights, community development, etc.)

B1. How are valuable thoughts and experiences of employees captured in the sustainability department of your firm?

   a) **Interviewing experts (the aim of this technique is to have a record of the knowledge, whether on paper, audio, video or paper media)**
   b) **Learning by being told (interviewee expresses his knowledge, Interviewer clarifies and validates the knowledge given by Interviewee and turns it into explicit form of knowledge)**
   c) **Learning by observation (Employees watch an expert show what he knows. This can be through audio, video or in person. Some things are hard to explain, but are understandable once an employee watches an expert do what he knows what to do).**
   d) Other:
   e) Don't Know
   f

> Comments: Because sustainability is a complex, rather than a transactional topic, we use (a), (b) and (c)

B2. Once the valuable thoughts and experiences from employees are captured, how does you firm convert this "undocumented" information to "documented "Information?

   a) Cognitive maps

385

b) Decision trees
c) Frames
d) Decision table
e) Production rules
f) Case Based reasoning
g) Don't Know
h) Other:

> Comments: (h) because sustainability is contextual approach rather than a binary "right/wrong approach, our knowledge and information is documented in our report on sustainability which is published annually.

B3.How are employee's expertise and thoughts stored within the sustainability department of your firm?

a) **Hard copies**
b) **Electronic copies**
c) **Central Electronic database (Company Intranet)**
d) No records held
e) Don't Know

> Comments:

B4. Who has access to the information recoded in question B3?

a) **All employees**
b) Employees working in the sustainability department
c) Specific people in the sustainability department
d) Don't Know

> Comments:

B5-B9. Please put an (X) mark inside the box of these knowledge management issues as they relate to your firm.

	Never	Seldom	Usually	Always	Don't know	Comments (If necessary)
B5. We capture knowledge by engaging in alliances or mergers between other firms in order to gain access to knowledge that was not previously available within the firm			X			We engage in ongoing discussions with other firms as well other stakeholders
B6. We capture knowledge by observing other firms demonstration of techniques or procedures			X			
B7.We capture Knowledge through experimental learning i.e knowledge that is created by doing and			X			

practicing						
B8. We capture Knowledge in the sustainability department by encouraging employees to question the underlying assumptions, values and beliefs behind what we do.				X		
B9. We prevent loss of knowledge from retiring operations employees and other turnover			X			
B10. Knowledge from one project to another is formerly captured, and employees learn about what made one project successful and another unsuccessful.				X		Although "lessons learned" is part of a every project, one must also challenge projects to think about "lessons retained"
B11. Our firm records and documents "Lessons Learned" on projects as a means of passing along the things that worked or did not work on a project.				X		See above comment
B12. We have regular "Project close out meetings" as soon as a project is completed to review what happened or what the team or the firm can learn from what happened.				X		This is part of our gated project process

B13.How is the information from the capturing methods in Questions B5 to B8 held?

      a) **Hard copies**
      b) **Electronic copies**
      c) **Central Electronic database (Company Intranet)**
      d) No records held
      e) Don't Know
      f) Other:

Comments:

B14. How does your firm pre-empt the risk of losing vital sustainable oriented knowledge from departing employees

      a) **Structured Interviews**
      b) Knowledge Transfer Techniques
      c) Other:
      d) Don't Know

Comments: As mentioned, we do use lessons learned processes so that learnings are captured from all employees

Section C: Knowledge Sharing and Learning

C1. Is sustainable oriented knowledge shared across the sustainability department through networking at peer level?

a) There is no sharing of knowledge through peer or social networks.
b) Communities of practice (CoP) and knowledge-sharing networks are rare.
c) **Either "Communities of practice" or knowledge-sharing networks are in place for some sustainability Projects, but not prevalent throughout the department**
d) CoP and Knowledge sharing exist throughout the sustainability department and are maintained and monitored and used to add value to the department by sharing lessons learned
e) Don't Know

Comments: There are sharing networks but I don't think they have a formal process for sharing sustainability information

C2. When a staff member comes across a problem with lack of experience or knowledge, what do they do? Please put an (X) mark inside the box that corresponds to your answer.

	Never				Seldom	Usually	Always
Have a discussion with other colleges							X
Conduct their own research						X	
Look into the firms database			X				
Access Hard copy files		X					
Google			X				
Read a manual		X					
Attend a training course		X					
Ask a community of practice		X					
Ask a social network		X					

Other:

C3. Does your sustainability department visually map the relations between people in order to identify knowledge flows e.g. who people seek information and knowledge form or who they share their informational and knowledge with?

a) Yes we do through Social network Analysis Charts
b) Yes we do through Organizational charts
c) Other
d) <u>Don't Know</u>

> Comments: We have begun the process of mapping relations on information flows, but this is a new process so I think we rely on individuals' experience and memory.

C4. How frequently does your firm use the following techniques to share sustainable oriented Knowledge? Please put an (X) mark inside the box that corresponds to your answer.

	Never	Seldom	Usually	Always	Don't know
Encourage mentoring and coaching			X		
Use quality circles to share sustainable oriented knowledge		X			
Utilize brainstorming techniques				X	
Write case notes on successful and unsuccessful processes		X			
Lessons learned systems				X	
Communities of practice			X		
Workshops				X	
Email				X	
Peer assist				X	
Training			X		

Other:

> Comments:

C5. Do good ideas through knowledge sharing lead to best practices (an improved way of doing things)?

a) Never
b) Seldom
c) Usually
d) Always
e) Don't Know

> Comments

C6. How is company best practices and key knowledge, created, owned, shared and maintained within the sustainability department of your firm?

a) None of the companies' key knowledge or knowledge on how best to do things is stored or available for future re-use.
b) **Key knowledge is collected and made available to a small portion of staff in the sustainability Department.** The key knowledge is however not routinely updated.
c) Key knowledge and best practices are stored and shared throughout the sustainability department. This knowledge is constantly maintained, updated and used for all sustainability related work within the firm.
d) Other
e) Don't know

Comments: some of the knowledge in (b) is updated but I don't know the frequency or the rigour of the updating process.

REFERENCES

Academy of Management. (2002). Academy of Management Code of Ethical Conduct. *The Academy of Management Journal*, 45(6), 1220-1223.

Academy of Management. (2005). *Code of Ethics.* Retrieved from http://www.aomonline.org/governanceandethics/aomrevisedcodeofethics.pdf

Ackoff, R. L. (1989). From data to wisdom. *Journal of Applied Systems Analysis*, 15:3-9.

Adams, E., and C.Freeman. (2000). Communities of practice: Bridging technology and knowledge assessment. *Journal of knowledge Management,* 4(1), 38-44

Akao,Y. (1990). *Quality function deployment.* Productivity press, Portland.

Ala- Harkonen, M., & Rutenberg, D.P. (1993). The dawn of organizational learning in the Mining industry. *Resources Policy*, 19 (3), 205-216.

Al-Ghassani, A.M. (2002). *Literature Review on KM Tools, Technical Report*, July 2002, Department of Civil and Building Engineering, Loughborough University, UK.

Anklam, P. (2003). *KM and the social network*. Retrieved from http://davidjf.free.fr/new/Xkm_km%20and%20the%20social%20network.pdf.

APQC. (1999). *Creating a Knowledge Sharing Culture. Consortium benchmarking study.* Houston, TX: American productivity and Quality Centre.

Argyris, C., and Schon, D. (1978). *Organizational learning: a theory of action perspective*. New York: McGraw-Hill

Arskey, H., Knight, P. (1999). *Interviewing for Social Scientists: An introductory resource with examples.* London, UK: Sage Publishing.

Awad, E.M. and Ghaziri, H.M. (2004). Knowledge management, Upper Saddle River, NJ, Pearson Education Inc.

Babcock, P. (2004). Shedding Light on Knowledge Management. *Human Resource Magazine,* 49 (5). Retrieved from http://www.shrm.org/Publications/hrmagazine/EditorialContent/Pages/0504covstory.aspx

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Barbara.D, B & Benjamin, F. C (2006). The Qualitative Research Interview. *Medical Education*, 40(4), 314–321.

Bennett, R., & Gabriel, H. (1999). Organizational factors and Knowledge management with large marketing departments: an empirical study. *Journal of Knowledge Management*, 3(3), 212 – 225.

Bloom, B., Meisa, B., & Krathwhol, R. (1964). *Taxonomy of educational objectives. Volumes 1 and 2*. New York: David McKay.

Borden Ladner Gervais LLP. (2012). Opportunities abound in Canadian capital markets. Retrieved from http://www.blg.com/en/newsandpublications/documents/Publication_3148.pdf

Botin A, J. (2009). *Sustainable Management of Mining Operations: An overview*. Retrieved from: http://oa.upm.es/5714/1/INVE_MEM_2009_70529.pdf.

Botin, J. A. (2009). *Sustainable Management of Mining Operations*. Littleton, Colo: Published by Society for Mining, Metallurgy, and Exploration

Bradburn, N. A., & Sudman, S. (1979). *Improving Interview Method and Questionnaire. Design*. San Francisco: Jossey-Bass.

Brown, J.S., & Duguid, P. (1998). Organizing Knowledge. *California Management Review,* 40 (3), 339-351.

Brown, S. A., Dennis, A. R., Burley, D.,& Arling, P. (2013). Knowledge sharing and knowledge management system avoidance: The role of knowledge type and the social network in bypassing an organizational knowledge management system. *Journal of the American Society for Information Science and Technology,* 64, 2013–2023.

Bryman, A., & Bell, E. (2007). *Business Research Methods*. New York: Oxford University Press.

Bukowitz, W., & Williams, R. (2000). *The Knowledge Management Fieldbook*. London, UK: Prentice-Hall.

Camarinha-Matos,L., Boucher,X., Afsarmanesh, H. (2010). *Collaborative networks for a sustainable world*. Germany: International Federation for information processing.

Camp, R. (1989). *Benchmarking: The search for the best practices that lead to superior performance*. Milwaukee, WI: ASQC Quality Press

Caplow, T. (1956). The Dynamics of Information Interviewing. *The American Journal of Sociology*, 62(2), 165-171.

Carnes, W. E., & Breslan, B. (2002), Lessons learned: improving performance through organizational learning. *IEEE International Conference on human factors and power plants,* Scottsdale, Arizona, 2.23-2.27.

Castrilli. F.S. (2010). Wanted: A Legal Regime to Clean Up. Orphaned /Abandoned Mines in Canada. *McGill International journal of Sustainable Development Law and Policy*, 6(2), 111-141.

Clarke, T (2001).The Knowledge Economy. *Education + Training.* 43(4/5), 189-196.

Cohen, W., & D. Levinthal. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly,* 35, 128 – 152.

Collison, C., & Parcell, G. (2001). *Learning to Fly – Practical Knowledge Management from leading and learning organizations*. Oxford: Capstone.

Commissioner of the Environment and Sustainable Development (CESD). (2002). *Abandoned Mines in the North: Report to the House of Commons*. Retrieved from http://www.oag-bvg.gc.ca/internet/docs/c20021003ce.pdf.

Connor, K.R., & Prahalad, C.K. (1996). Are source-based theory of the firm: knowledge versus opportunism. *Organization Science*, 7(5), 477-501.

Contu, A. and Willmott, H. (2000). 'Comment on Wenger and Yanow. Knowing practice: a "delicate flower" in the organizational learning field'. *Organization*, 7(2), 269–76

Cooke, P., & Leydesdorff, L. (2006). Regional Development in the Knowledge-Based Economy: The Construction of Advantage. *The Journal of Technology Transfer,* 31(1), 5-15.

Cope. (2000). *Know your value? Value what you know*. New York: Financial Times Prentice Hall

Cotrell.R.R., McKenzie.F.J.(2011). *Health promotion and education research methods*. Canada: Jones and Bartlett Publisher Canada.

Dalkir, K. (2011). *Knowledge Management in Theory and Practice*. Cambridge, Massachusetts: The MIT Press.

Damodaran, L., & Olphert, W. (2000). Barriers and facilitators to the use of knowledge management systems. *Behavior & Information Technology,* 19(6), 405-413.

Davenport, T., & Prusak, L. (1998). *Working Knowledge- How Organizations Manage What They Know.* Boston, MA: Harvard Business School Press.

Davenport, T., De Long, D., & Beers, M. (1998). Successful knowledge management projects. *Sloan Management Review,* 39(2), 43-57.

Davenport, T. H., & Prusak, L. (2000). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.

De Long, D.W., Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *The Academy of Management Executive*, 14(4), 113-27.

Diener, E., &Crandall, R. (1978). *Ethics in Social and Behavioral Research*. Chicago: University of Chicago Press.

Dillon, A. & Morris, M. (1996). *User acceptance of information technology: theories and models. Annual Review of Information Science and Technology*. Medford NJ: Information Today, Inc.

Dion, P., Mills, A. M., & Smith, T. A. (2010). Linking business strategy and knowledge management capabilities for organizational effectiveness. *International Journal of Knowledge Management*, 6(3), 22+

Donath, J. (2002). A semantic approach to visualizing online conversations. *Communication of the ACM,* 45(4), 45-49.

Drucker.P.F. (1988) .The Coming of the New Organization. *Harvard Business Review*, 45-53.

Environmental Commissioner of Ontario. (2013). *2012/2013 Annual Report: Serving the Public*. Retrieved from http://www.eco.on.ca/

ESMAP, World Bank, and ICMM. (2005). *Community Development Toolkit*. Retrieved from https://www.icmm.com/document/2#page=3&zoom=auto,0,577

Fahey, L., Prusak, L. (1998). The Eleven Deadliest Sins of Knowledge Management. *California Management Review.* 40 (3), pp 265-276

FAO. (1990). The *community's toolbox: The idea, methods and tools for participatory assessment, monitoring and evaluation in community forestry.* Retrieved from http://www.fao.org/docrep/x5307e/x5307e00.htm#Contents.

Fernandez, B, I., & Sabherwal, R. (2010). Knowledge *management systems and processes.* Sharp Inc.: New York.

Fernandez, I., & Leidner, D. (2008). *Knowledge Management: An Evolutionary View*. Armonk, NY: M.E. Sharpe, Inc.

Fielding, N., &Thomas, H. (2001). *Researching Social Life.* Sage Publishing: London.

Flick, U. (1998). An *introduction to Qualitative Research*, Sage: London.

Ford, D., & Chan, Y. (2002). *Knowledge Sharing in a Cross-Cultural Setting: A Case Study* (No. 02-09).Kingston: Queen's School of Business, Queen's University at Kingston.

Fox, S. (2000). 'Communities of practice, Foucault and actor-network theory'. *Journal of Management Studies*, 37(6), 853–67

Fullam, M. (2001). *Leading in a culture of change*. San Francisco:Jossey-Bass .

Ganesh,D. B. (2001). Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management*, 5(1),68 – 75.

Garvin, D. A. (1993). Building a Learning Organization. *Harvard Business Review*,71(4) 78-9.

Garvin, D.A. (1998). Building a Learning Organization. *In Harvard Business Review on Knowledge Management.* Boston, Massachusetts: Harvard Business Review.

Gery, G. (1991). *Electronic Performance support Systems.* Cambridge, MA: Ziff institute.

GlobeScan (2006), *Corporate Social Responsibility Monitor 2005*. Available at www.GlobeScan.com

Gloet.M. (2006). Knowledge management and the links to HRM: Developing leadership and management capabilities to support sustainability. *Management Research News*, 29(7), pp.402 – 413.

Godin, B. (2006). The knowledge-based economy: Conceptual framework or buzzword.? *The Journal of Technology Transfer,* 31, 17-30.

Gofee, R., &Jones,G. (2000). *The character of a corporation: How your company's culture can make or break your business.* New York: Harper Business.

Gold, A.H., Malhotra, A., Segars, A.H. (2001). Knowledge management: an organizational capabilities perspective. *Journal of Management Information Systems*, 18(1),185-214

Goodland.R. (1995). The Concept of Environmental Sustainability. *Annual Review of Ecology and Systematics,* 26, 1-24.

Government of Canada. (2011). Corporate Social Responsibility. Retrieved from
https://www.ic.gc.ca/eic/site/csr-rse.nsf/eng/rs00555.html

Grant, K. A. (2007). Tacit Knowledge Revisited – We Can Still Learn from Polanyi. *The Electronic Journal of Knowledge Management*, 5(2), 173 - 180

Grant.M.R. (2013). *The development of knowledge management in the oil and gas industry.* Retrieved from http://ubr.universia.net/pdfs_revistas/articulo_352_1381330772384.pdf

Grant, R.M. (1996).Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(4), 109-22.

Gruber, H., & Duxubury,L.(2000). Does organizational culture effect the sharing of knowledge?. The case of a department in a high technology department. *In Proceedings of the 28th Annual ASAC Conference, Technology and innovation management Division,* Montreal, Quebec.

Gurteen, D. (1999). Creating a knowledge-sharing culture. *Knowledge Management*, Vol. 2 No.5

Hall, R. (1993). A framework linking intangible resources and capabilities to sustainable. competitive advantage. *Strategic Management Journal*, 14(8), 607-618.

Handley, K., Sturdy, A., Fincham, R. and Clark, T. (2006). 'Within and beyond communities of practice: making sense of learning through participation, identity and practice'. *Journal of Management Studies*, 43, 3, 641–53.

Hauser, J., Clausing, D. (1988). The house of quality. *Harvard Business Review*, 3, 63-73

Hendriks, P.H.J. (2004) Assessing the Role of Culture in Knowledge Sharing, *In Proceedings of Fifth European Conference in Organization, Knowledge, Learning and Capabilities (OKLC 2004)*, Innsbruk

Hendriks, P. H. J. (1999). Why share knowledge? The influence of ICT on the motivation for knowledge sharing. *Knowledge and Process Management,* 6(2), 91-100.

Huber, G.(1991). Organizational learning: The contributing processes and a review of the literatures. *Organizational Science*, 2(1), 88-11.

Humber.G.P(1984). The nature and design of post- industrial organizations. *Management Science,* 30, 928-951

Hurwitz, J., Lines, S., Montgomery, B. and Schmidt, J. (2002). The linkage between management practices, intangibles performance and stock returns. J*ournal of Intellectual Capital*, 3(1), pp. 51-61.

Inkpen, A.C., & Beamish,W.P. (1997). Knowledge, bargaining power and the instability of international joint ventures. *Academy of Management Review*, 22(1), 177-202.

International Institute for Sustainable Development.(2002). *Seven Questions to Sustainability: How to Assess the Contributions of Mining and Mineral Activities.* Retrieved from http://www.iisd.org/pdf/2002/mmsd_sevenquestions.pdf

Ismail, Z. and Fakir, T. (2004). Trademarks or trade barriers? Indigenous knowledge and the flaws in the global IPR system. *International Journal of Social Economics*, 31(1), pp. 173-94.

Jarvenpaa, S.L., Staples, D.S. (2001). Exploring perceptions of organizational ownership of information and expertise. *Journal of Management Information Systems*, 18(1),151-84

Jayawardena.A. (2011). *Knowledge Management systems.* Retrieved from t *turing.une.edu.au/~comp292/Slides/Lecture_06/Lecture_6.pp*

Yelden. E.F and Albers.A.J. (2004). The Business Case For Knowledge Management. *Journal of Knowledge Management Practice*. Retrieved from http://www.tlainc.com/articl69.htm

Jelenic. D. (2011). The importance of knowledge management in organizations- with emphasis on the balanced scorecard learning and growth perspective. Retrieved form http://www.issbs.si/press/ISBN/978-961-92486-3-8/papers/ML11-1.pdf

Jennex, M.O., & Pituma, P. (1998). An organizational memory information systems success model: An extension of DeLone and McLean's I/S success model. *Proceedings of the 31st Annual Hawaii International Conference on System Sciences,*1, 157-165.

Jing Tian, Yoshiteru Nakamori, Andrzej P. Wierzbicki.(2009).Knowledge management and knowledge creation in academia: a study based on surveys in a Japanese research university. *Journal of Knowledge Management*, 13(2),76 – 92.

Jones, N.B., Herschel R.T., Moesel, D.D. (2003). Using "Knowledge Champions" to Facilitate Knowledge Management. *Journal of Knowledge Management* , 7 (1), 49-63.

Kaplan, R., & Norton, D. (1992). The balanced scorecard-Measures that drive performance. *Harvard Business Review*, 70(1), 71-79.

Kaplan, R., & Norton,D. (1993). Putting the balances scorecard to Work. *Harvard Business Review*,71(5), 134-147.

Kaplan, R., and Norton,D. (1996). Using the balances scorecard as a strategic management system. *Harvard Business Review,* 74(1), 75-85.

Kilmann, R., M.S., & Serpa,R. (1986). *Issues in understanding and changing culture. California Management Review.* 28(2), 87-94.

Klein, D.(1998). *The strategic management of intellectual capital*. Oxford, UK: Butterworth-Heineman.

Knoco.(2013).*Knowledge Management*. Retrieved from http://www.knoco.com/

Kolb, D. (1984). *Experiential Learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

KPMG. (2011). *Corporate Sustainability.* Retrieved from https://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/corporate-sustainability-v2.pdf

Kraft, R. G. (1994).*Bike riding and the art of learning*.In L. B. Barnes, C. Roland Christensen, & A. J. Hansen (Eds.), *Teaching and the case method*. Boston: Harvard Business School Press.

Kvale, S. (1996). *Interview: An Introduction to Qualitative Research Interviewing*.London: Sage Publishing.

Laabs J (2000). Need peak HR performance? Consider a coach. *Workforce*, vol 79 no 10, pp 132-135

Lave.J., Wenger,E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Liebowitz, J. (2005). Linking social network analysis with the analytic hierarchy process for knowledge mapping in organizations. *Journal of Knowledge Management*, 9(1),76-86.

Lorne,D,B., Bontis,N.,& Serenko,A. (2008). The Relevance of Knowledge Management and Intellectual Capital Research. *Knowledge and Process Management*, 15 (4), 235–246.

Lwoga, E. T., Ngulube, P., & Stilwell, C. (2010). Managing indigenous knowledge for sustainable agricultural development in developing countries: Knowledge management approaches in the social context. *The International Information & Library Review*, 42(3), 174-185.

Maier, R., & Remus, U. (2002). Defining process-oriented knowledge management strategies. *Knowledge and Process Management*, 9(2), 103-118.

Maki, E., Jarvenpaa.E. & Ziegler, K. (2004). Communication and knowledge sharing in a decentralized organization. *Proceedings of the 5th European Conference on Organizational Knowledge, Learning and Capabilities*, 2.-3.4.2004, Innsbruck, Austria.

Malhotra, Y.(2000). *Knowledge Management and Virtual Organizations*. London: Idea Group Publishing.

Marianne,G.(2006).Knowledge management and the links to HRM: Developing leadership and management capabilities to support sustainability. *Management Research News*, 29(7), 402 – 413.

Markus, M. L. (2001). Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success. *Journal of Management Information Systems, 18*(1), 57-93.

Marshall, N. and Rollinson, J. (2004). 'Maybe Bacon had a point: the politics of interpretation in collective sensemaking'. *British Journal of Management*, 15, S71–S86.

McAllister, D.J. (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organisations. *Academy of Management Journal*, Vol. 38 No.1, pp.24-59.

McDermott, R., O'Dell, C. (2001). Overcoming culture barriers to sharing knowledge. *Journal of Knowledge Management*, 5(1), 76-85.

McElroy, M.(1999). The Knowledge Life Cycle. *ICM Conference in KM,* Miami FL.

McGill, M. E., & Slocum, J. W. (1994). *The smarter organization: how to build a business that learns andadapts to marketplace needs.* New York: Wiley.

Meyer, M., & Zack,M.(1996). The design and implementation of information products. *Sloan Management Review*, 37(3), 43-59.

Michailova, S., Husted, K. (2003). Knowledge-sharing hostility in Russian firms. *California Management Review*, 45(3), 59-77.

Milton,N. (2005). *Knowledge Management: For teams and Projects.*Oxford,UK:Chandos Publishing.

Mintzberg, H .(1990). *Strategy formation: Schools of thought . In perspectives of strategic management*.Frederickson. New York: Harper Business

Mirghani, M., Stankosky, M., & Mohamed, M. (2009). An empirical assessment of knowledge management criticality for sustainable development. *Journal of Knowledge Management,* 13(5), 271-286.

Mohamed A.F. Ragab, Amr Arisha.(2013).Knowledge management and measurement: a critical review. *Journal of Knowledge Management*, 17(6), 873 – 901.

Montgomery, David B. and Ramus, Catherine A. (2003). *Corporate Social Responsibility Reputation Effects on MBA Job Choice .* Stanford GSB Working Paper No. 1805. Available at SSRN: http://ssrn.com/abstract=412124 or http://dx.doi.org/10.2139/ssrn.412124

Morteza Shokri-Ghasabeh, Nicholas Chileshe. (2014).Knowledge management: Barriers to capturing lessons learned from Australian construction contractors perspective. *Construction Innovation: Information, Process, Management*, 14(1), 108 – 134

Moss Kanter, R. (1996). *When a thousand flowers bloom: structural, collective and social conditions for innovation in organizations*. In P. Myers (Ed.), Knowledge management and organizational design (pp. 93- 132). Boston: Butterworth-Heinemann.

Murray, P. (2002), Knowledge management as a sustained competitive advantage. *Ivey Business Journal*, Vol. 66 No.4, pp.71-7.

Mutch, A. (2003). Communities of practice and habitus: a critique. *Organization Studies*, 24, 3,383–401.

Neef.D. (1998). *The Knowledge Economy*. Woburn,MA: Butterwirth-Heinemann.

Nevo, Dorit. (2003). *Developing Effective Knowledge Management Systems*. PhD thesis, University of British Columbia

NHS. (2005). *ABC of Knowledge Management*. Available at http://www.fao.org/fileadmin/user_upload/knowledge/docs/ABC_of_KM.pdf

Norwood.S.L (2002). *Research strategies for advanced practice nurses*. Upper Saddle River, N.J: Prentice-Hall.

Nonaka, I., & Takeuchi,H. (1995). *The Knowledge creating company: how Japanese companies create the dynamic of innovation*. New York: Oxford University Press.

North, K.,Reinhardt, R., & Schmidt, A. (2004). The Benefits of Knowledge Management: Some Empirical Evidence. *Proc. The 5th European Conference on Organizational Knowledge, Learning and Capabilities,* Innsbruck, Australia. Retrieved form http://www2.warwick.ac.uk/fac/soc/wbs/conf/olkc/archive/oklc5/papers/a-8_north.pdf

O'Dell, C., Grayson, C.J. (1998). If only we knew what we know: identification and transfer of internal best practice. *California Management Review*, 40(3), 154-74.

OECD .(1996). *The knowledge based Economy*. Retrieved form http://www.oecd.org/sti/sci-tech/1913021.pdf

Oliver, P. (2006). *Purposive Sampling*. In V. Jupp (Ed.), *The SAGE Dictionary of Social Research Methods.* (pp. 245-246). London, England: SAGE Publications, Ltd

Oxford Dictionaries. (2014). UK: Oxford University Press

Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA: Sage.

Papavramides, T. C., (2006), High order organizational learning in air navigation services: the role of cross functional teams, *IEEE International Engineering Management Conference*, 446-451.

Papoutsakis, H. (2007). Sharing Knowledge in the Organization: a Retrospective Analysis and an Empirical Study. *Electronic Journal of Knowledge Management*, 5 (2), 231-244.

Parise.S., Rob.C., and Thomas.H.D.(2006). *Strategies for Preventing a Knowledge-Loss Crisis. MIT Sloan Management Review*, 47(4), 32-38

Parsaye, K. 1988. Acquiring and verifying knowledge automatically. *AI Expert*, 3(5) 48-63

Pasternack, B., &Viscio,A. (1998). *The Centerless corporation*. New York:Simon and Schuster.

Pennings. J., Barkema,H., Douma.D. (1994). Organizational learning and diversification. *Academy of management Journal*, 37, 608-640

Pfeffer, J., & Sutton,R.(1999). *The Knowledge -doing gap: How smart companies turn knowledge into action*. Boston, MA: Harvard Business School Press

Plan net (2003). *Splah and ripple! Planning and managing for results.* Retrieved from http://www.plannet.ca/

Polanyi, M. (1958). *Personal Knowledge: Towards a Post-Critical Philosophy*. Chicago: University of Chicago Press.

Polanyi ,M. (1962). Tacit knowledge. It's bearing on some problems of philosophy. *Review of Modern Physics, 34(4), 18-20.*

PricewaterhouseCoopers in conjunction with the world economic forum. (2003). *6th annual global CEO survey.* Retrieved from http://collection.europarchive.org/dnb/20070702132253/pwc.com/gx/eng/inssol/survey-rep/ceo6/pwc_6_ceo_survey.pdf

Probst, G., Raub, S., Rombhardt, K. (2000). *Managing Knowledge*. Chichester: John Wiley & Sons.

Quast,L.(2012). *Why Knowledge Management Is Important To The Success Of Your Company.* Retrieved from http://www.forbes.com/sites/lisaquast/2012/08/20/why-knowledge-management-is-important-to-the-success-of-your-company/

Ramanogopal,C,S. (2012). Knowledge management for the oil and gas industry: Opportunities and challenges. Asian Journal of Business and Economics, 1-12

Redclift.M. (1992). The Meaning of Sustainable Development."*Geoforum*, 25 (3), 395-403.

Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management, 9*(3), 18-35

Robb, D. (2003). Assembling Knowledge Management Teams. *Information Strategy: The Executive's Journal*, 19(2), 37.

Roberts.J. (2006). Limits to communities of Practice. *Journal of management Studies,* 43(3), 623-639

Robson, C. (1993). *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*. Cambridge, Massachusetts: Blackwell.

Rollet.H. (2003). *Knowledge management processes and technologies.* Norwell, MA: Kluwer Academic Publishers

Romer., &Paul, M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy,* 94(5), 1002-1037.

Romer., & Paul, M. (1990). Endogenous Technological Change. *Journal of Political Economy*, 98(5), 71-102.

Rose,K .(1994).Unstructured and semi-structured interviewing. *Nurse Researcher*, 1(3), 23-32.

Rowledge, L. (1999). Knowledge Management for Sustainable Value Creation. *Retrieved from* available at: www.ekosi.com

Rowley, J.E. (2002). Reflections of customer knowledge management in e-business. *Qualitative Market Research*, 5(4), 268-81.

Ruggles, R.,& Holtshouse, D .(1999). *The Knowledge Advantage*. Dover, New Hampshire: Capstone Publishers.

Ruggles. R.(1997). *Knowledge tools: Using technology to manage knowledge better.* Boston: Butterworth-Heinemann.

Sandelowski, M. (1995), Sample size in qualitative research. *Res. Nurs. Health*, 18: 179–183.

Schein.E. (1999). *The corporate culture survival guide: Sense and nonsense about cultural change*. San Fransisco: Jossey-Bass

Schein, E. (1985). *Organizational Culture and Leadership*. San Francisco: Jossey-Bass.

Seufert, A., G. von Krogh, and A.Bach. (1999). Towards knowledge networking. *Journal of Knowledge Management,* 3(3), 180-190

Shipton. H. (2001). *Organizational Learning: quantitative v. qualitative approaches – selecting the appropriate methodology.* Retrieved from *http://www.wlv.ac.uk/pdf/uwbs_op02_01_shipton.pdf*

Sica,G.T. (2006).*Bias in research studies. Radiology*, 238,780-789.

Siebenhüner, B., & Arnold, M. (2007).Organizational learning to manage sustainable development. *Business Strategy and the Environment*, 16, 339–353.

Simmons, R. (2001). Questionnaires. In Gilbert, N. *Researching Social Life. 2nd Edition.* London,UK :Sage Publishing.

Skyrme, D. (2000). *Developing a knowledge strategy: from management to leadership*, in Morey, D. (Eds),*Knowledge Management*, Cambridge, MA: MIT Press

Skyrme, D. (2001). *Capitalizing on knowledge: from e-business to k-business*. Boston: Butterworth-Heinemann.

Spekman, R.E., Spear, J. and Kamauff, J. (2002). Supply chain competency: learning as a key component. *Supply Chain Management: An International Journal*, 7(1), pp. 41-55

Spendolini, M. (1992). *The benchmarking Book*. Newyork: AMACOM

Srikantajah,T., and Koenig, M. (2000). *Knowledge management for the information professional*. Medford, NJ: Information Today.

Srikantaiah,K.T., Koenig,D.E.M., Hawamdeh,S. (2010). *Convergence of Project Management and Knowledge Management*. United Kingdom: The Scarecrow Press Inc.

Stauffer, D. (1999). Why people hoard knowledge. *Across the Board*, 36(8), 16-21.

Stewart, T. (1997). *Intellectual Capital.* New York:Doubleday.

Strandberg Consulting. (2009). *The business case for sustainability*. Retrieved from http://corostrandberg.com/wp-content/uploads/files/Business_Case_for_Sustainability_21.pdf

Starbuck, W. (1992). Learning by knowledge intensive firms. *Journal of Management Studies* , 29 : 713–740.

Subashini.H., Charles.E., Bimal.K. (2005). A knowledge capture awareness tool: An empirical study on small and medium enterprises in the construction industry. *Engineering, Construction and Architectural Management*, 12(6), 533 – 567

Sunderlin.W.D. (1995). Managerialism and the Conceptual Limits of Sustainable Development. *Society and Natural Resources,* 8, 481-492.

Swanborg Jr., R. W. & Myers P. S. (1997). *Wise Investments*. CIO Magazine, 15 Oct

Trevor. A.S., Annette.M.M., Paul.D. (2010). Linking business strategy and knowledge management for organizational effectiveness. *International Journal of Knowledge Management*, 6(3), 22-43

TFPL. (2000). *TFPL KM skills map*. Available at https://www.tfpl.com/resources/tfpl-reports

The Boston Consulting Group. (2009). *The business of sustainability: imperatives, advantages and actions.* Retrieved from www.bcg.com/documents/file29480.pdf

Tiwana, A. (2000). *The Knowledge Management Toolkit*. Upper Saddle River, NJ: Prentice Hall

Tiwana, A. (2002).*The Knowledge Management Toolkit*. Upper Saddle River, NJ: Prentice-Hall

Tschannen-Moran, M. (2001). Collaboration and the need for trust. *Journal of Educational Administration*, 39(4), 308-31.

UK Government, Department for Business Innovation & Skills. (2006). S*ustainable Business.* Retrived from http://webarchive.nationalarchives.gov.uk/+/http://www.dti.gov.uk/sustainability/bo/sb.ht m

United Nations Development Programme. (UNDP). (2003). *Human development report 2003: millennium development goals: A compact among nations to end human poverty*. Retrieved from http://hdr.undp.org/en/reports/global/hdr2003

United Nations Environment Programme, Division of Technology, Industry and Economics. . (2001). *Abandoned Mines - Problems, Issues and Policy Challenges for Decision Maker* . Retrieved from http://commdev.org/userfiles/files/1804_file_abandoned_report.pdf

Urch-Druskat, V., Wolff, S.B. (2001). Building the emotional intelligence of groups. *Harvard Business Review*, 79(3).80-9.

Van der Westhuizen, C., & Kok, A.J. (2006). Intellectual Capital in a retail company in South Africa. *South African Journal of Information Management*,8(4), 1-15.

von Krogh, G., Roos, J. (1996). *Managing Knowledge: Perspectives on Cooperation and Competition*. London: Sage Publications

Wathne, K., Roos, J. and von Krogh, G. (1996).*Towards a theory of knowledge transfer in a cooperative context*. In von Krogh, G. and Roos, J. (1996). *Managing Knowledge: Perspectives on Cooperation and Competition*. London: Sage.

Wax, M.L., & Cassell, J. (1981). From Regulation to Reflection: Ethics in Social Research. *The American Sociologist,* 16,224-229.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. New York: Cambridge University Press

Wenger, E., McDermott, R. and Snyder, W. M. (2002).*Cultivating Communities of Practice: A Guide to Managing Knowledge*. Boston, MA: Harvard Business School Press.

Whiting, L. (2008). Semi-structured interviews: guidance for novice researchers. *Nursing standard*, 22(23), 35-40.

WHO. (2014). *How to investigate the use of medicines by consumers.* Retrieved form http://apps.who.int/medicinedocs/en/d/Js6169e/5.4.html

Wiig, K. (1993). *Knowledge Management foundations*. Arlington. Texas: Schema Press

World Bank. (2011). *Knowledge for Development*. Retrieved form http://go.worldbank.org/94MMDLIVF0

Wu, J., & Haasis, D. H. (2011).Knowledge Management for Sustainability-oriented Freight Villages. *IEEE International conference on, Knowledge Information, Industrial Management and Applications*, 1-8

Yakovleva, N. (2005). *Corporate Social Responsibility in the Mining Industries*. England: Ashgate Publishing.

Young. (2010). *Knowledge management Tool and techniques Manual*. Retried from http://www.apo-tokyo.org/publications/files/ind-43-km_tt-2010.pdf

Zack, M. (1999). Developing a knowledge strategy. *California Management Review*, 41(3), 125–145

Zins, C. (2007). Conceptual approaches for defining data, information, and knowledge. *Journal of the American Society for Information Science and Technology,* 58, 479–493.