UNIVERSITY OF LIVERPOOL

Title:

Interrelationship Between KM Strategies and e-Business Strategies in Support of Transformation to a Knowledge-Based Organisation; A Study of Oil and Gas Industry

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ABSTRACT

Two major new strategies of modern organisations, transforming to a Knowledge Based Organisation (KBO) to survive and gain sustained competitive advantage, and adopting ICT and Web enabled strategies (e-Business) are becoming increasingly interdependent. This is a critical factor particularly in the oil and gas industry especially in countries with oil-based economies. Research in this area is still growing and gaps exist in the knowledge of the subject. A comprehensive research on e-business strategies and the role of a KBO in developing and implementing it, with a view to integrate it with Knowledge Management (KM) strategy and KM systems, in the oil and gas industry, is the focus of this research. How e-business strategies and KM strategies are interrelated, what factors determine the effectiveness and success of each of the strategies, and how these factors interact in the overall success of the organisation to become a modern KBO are the questions the research seeks answers for. A research model was developed after the integration of KM and e-business models and strategies and a KBO model, which were designed as a conceptual framework. Conceptually the outcome of the integration of KM and e-business strategies for transforming an organisation to a KBO would be an e-enabled knowledge network. The research propositions were designed based on the research model. A qualitative research methodology was designed and methods including a case study and interviews were used to collect data with a semi-structured questionnaire supported by secondary data. An expert panel was also formed of seven academic and professional experts in the Iranian oil and gas industry. The outcomes from the panel included identifying cases studies (NIOC and NIGC and their subsidiaries (31 SBUs and companies) based on the Bain model), validating the research model and the questionnaire based on method of the CVI (The index of content validity), and also performing final review of the results. The research results were analysed using Nvivo. The study demonstrated how e-business strategy and KM strategy should be developed and integrated to support the organisation to become a KBO. The results show that the e-enabled knowledge network assists an organisation to become a KBO, when it impacts on internal competencies, strategic capabilities and organisation performance. Also, technological, organisational and individual barriers, which prevent the organisation to become a knowledge-based organisation were identified in the oil and gas industry.

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CHAPTER 1: INTRODUCTION

Introduction

The business of oil and gas has always been and is a highly competitive business. There is no true differentiation in products, companies are not really competing on product nor do they compete on technology. The rivalry concerns the implementation of technology as well as the employment of knowledge (Milton, 2009). Nowadays, the organisations have changed their perspective from product-base view (success is selling more of products) and market-base view (finding the markets through concentration on less customers although addressing a broader variety of their requirements (Buckman, 2004)) to knowledge-based view (knowledge as the comprising the most significant strategic resource, and, in that regard, this view comprises a broadening of the resource-based view for the company) (De Carolis, 2002).

The knowledge approach is especially appropriate for modern organisations working within a setting which is knowledge-intensive. Knowledge comprises an especially powerful tool in the formation of competitive advantages, and for the purpose of knowledge being valuable it should be distinguished and protected from the competition. So as to distinguish knowledge, it has to be special and complicated to replicate. This needs that the knowledge formed and implemented by the company to be planned according to its particular processes and beliefs (Kasten, 2007).

The gas and oil industry has made the most of knowledge management (KM) advancements for over two decades. Within that period, the oil and gas industry has experienced rapid changes and numerous mergers to the extent that a petroleum firm bearing a one-worded name is rare. All through the rapid progress of technology, an expansion of drilling offshore, several acquisitions, the increasing dependence on international supplies of oil, and a focus on issues of environmental, KM efforts have had a role in organising and managing activities additionally effective and efficient. For example, when gas and oil companies have had to deal with new technology, outsourcing, new partnerships, as well as regulations of government, their KM teams have supported by means of transfer of technology and knowledge, in addition to management of assets.

Following the recent appearance of business being carried out over the internet, firms are predictably employing information technology to reduce expenses, raise productivity as well as decrease the time necessary to produce new productions and use the combined skills of their staff, and form an extended enterprise through the creation of closer associations with their

distributors, suppliers, customers as well as partners so as to remain competitive (Mingqiang and Zuxu, 2009).

Also, the increasing rate of uncertainty and change with the business environment on one hand, and the emergence of the new economies of information and networks, organisational survival increasingly becomes dependent on the integration and construction of knowledge promoting the adaption to the setting, in addition to stimulating environmental changes by practices and knowledge of the company (Liao et al., 2008).

To face such new challenges organisations are driven to become knowledge based, which requires the organisation to manage its procedures of creation and dissemination of knowledge, creating its competitive strategies with consideration to knowledge and observing knowledge in any resolution created (Zack, 2003). According to Neagu (2008) a knowledge-based organisation (KBO) is one which intelligently creates and uses knowledge through implementation of the right organisational culture, supported by a flexible organisational structure, and application of the correct mixture of communication technologies and information so as to encompass all processes of conversion of knowledge to the organisation both internally and externally. Also a KBO is one in which its main staff is constituted of skilled and well-educated people, and forms market value by means of efficient implementation of knowledge to the provision of service for its customers (Deng, 2008). On the other hand, transforming to a KBO in parallel with the adoption of ICT and Web enabled strategies (e-business), as two major new strategies of modern organisations for sustained competitive advantage, are becoming increasingly interdependent.

Such strategic orientation comprises an essential aspect within the strategic oil and gas industry, especially in oil-based economies. Research in this area is still growing and gaps exist in this area of knowledge.

The capability of an organisation to survive and be successful within the knowledge-based economy is mostly reliant on its capability to organise and lead organisational knowledge and embody it through new services and products (Deng, 2008). Although technological progress has facilitated the attainment of massive improvements in performance by numerous companies in the way in which they carry out business, technology solutions on their own are insufficient (Deng, 2008). More companies have progressively acknowledged that their main asset and their sole maintainable supply of their competitive advantage is comprised of their capability to apply organisational knowledge productivity (Nah et al., 2005).

Knowledge management strategy and knowledge strategy are developed by organisations and these strategies using KM systems are implemented. Such perspective to institutionalise and utilise knowledge is becoming dependent on use of technology and in certain Information and Communication Technology (ICT), as main enablers for transferring to KBO. ICT can support to organise the company-wide knowledge to conserve, regulate, integrate and provide easy availability of related knowledge by means of easy-to-use knowledge management platforms, for which companies make and integrate different knowledge repositories associated with the people, group and different domains of organisation (Shankar and Gupta, 2005).

On the other hand with the advent of ICT based technological innovations, in particular web and internet (of things), and emergence of network economies, firms are driven to adopt e-business strategies. e-Business, describe as any business or managerial operation or exchange of information carried out by an organisation using a network (Lin, 2008), concerns establishing new ways of working by creatively developing the new abilities of ICT generally and especially internet and technologies associated with ICT (Qingfeng, 2008). e-Business in its core is about managing knowledge of the organisation, originated internally or acquired from external sources, and hence deeply dependent on the knowledge and KM strategies of organisations. As suggested by Matlay (2003) developing organisational learning and knowledge management strategies are effective and efficient means of successful technological innovation.

Despite extensive innovations and development of ICT and e-business systems many organisations as yet have not altered the way in which they work to the abilities of the contemporary technology and knowledge management enablers. An additional common aspect is that organisations have not yet developed models and methodologies to build e-business strategies to support corporate strategies of organisation (including KM strategies), nor to monitor the profitability of an e-business strategy (Julta et al., 2001).

Problem Definition

Knowledge Management (KM) is a key factor with an essential role in the oil and gas industry (Carrillo, 2004). Having worked in this strategic industry for many years and being involved in the development and implementation of KM systems in NIOC and NIGC, emphasising the importance of KM for the industry is not an overstatement. My experience has in fact been my main motivation to approach an academic research on this study.

The oil business is increasingly becoming a global business making the challenges facing this sector as common challenges, and hence global solutions are needed to be shared and applied across the networks of the industry's supply chains. The oil business has always been and is a highly competitive business (Van den Hove et al., 2002). There is no true differentiation in products, companies are not really competing on product nor do they compete on technology. The competition is all about the application of technology, and the use of knowledge (Milton, 2009).

The Lessons Learned systems are crucial for delivering performance improvement in the risky and expensive world of the international and offshore megaprojects. Such systems have been witnessed to be applied with rigor only in few occasions (Ramanigopal, 2010). KM based systems have proven to benefit from the advances in Information and Communication Technology (ICT), and hence have found organic relationship with the development of theories and practice of e-business strategies (Jennex, 2010). Within such systems, professional and practice networks play a crucial rule. To link individuals in communities of practise (COP), discussion forums are vitals when can be supplemented practically through technologies of real-time collaboration (Hoadley and Kilner, 2005). "Virtual teamwork" project of BP has demonstrated how videoconferencing could be utilised to solve local problems and bring skilled individuals and global knowledge (Alavi and Tiwana, 2002). Also, User-populated knowledge bases are valued instruments here; for instance, Schlumberger has used HUB service on intranet of the company as a portal strategy (Ahaiwe et al., 2015). This system is utilised as a document and discussion forum for their COPs and a virtual workspace for communicating groups (O'Brien and Richey, 2009). Shell is using and developing "Shell Wiki" that is connected to the Shell University and is one-stop shop for reference material (Milton, 2009).

The majority of information, which is in exchange in the organisation, is mainly about their business processes, rules and relationships (Bukowitz, 1999). Many organisations are suffering from the information overload and are looking for suitable representation of information (knowledge) to benefit the organisation in the most efficient and effective way. e-Business strategies have emerged in the recent years offering considerable opportunities as well as risks to the business that should be critically identified before creating the strategy (Phan, 2003). Leveraging knowledge is found as one of the success factors for e-business strategy as a new mode of global economy (Plessis, 2004).

e-Business strategy has influences on efficient and effective sources of KM when it is utilised in organisation (Fahey et al., 2001):

- The organisation is enabled by e-business strategy in the context of customer relationship management (CRM) with knowing more about its suppliers, partners and customers with linkages and relationships with the organisation (Wickramasinghe, 2002).

- The organisation is enabled to recognise what is required, what materials are available, how the organisation operates these materials, how it markets and serves the customers and how it delivers the services or products (distribution channels) through e-business strategy in the context of supply chain management (SCM) (Burn, 2002).

- KM supports the teamwork in the organisation and connects the management levels with all project stakeholders through sharing expertise and experiences (Bhirud et al., 2005).

- Processes of KM manage, assimilate and store data, information and knowledge in different knowledge bases in the organisation. This knowledge leads to improve the organisation performance and support the processes of the decision making (Tiwana, 2001).

Both KM and e-business are emerging sciences and new too many oil industries particularly in oil and gas exporting countries (especially the Middle East countries) (Smith and Farquhar, 2000). Understanding application of such systems can help managers in the oil and gas companies in decisions making, managing customers and suppliers, and also utilising the resources towards their competitive objectives.

With the emerging challenges of preserving the natural resources and switching to renewable energies and issues related to global warming the industry needs to approach the access and management of the resources in accordance with such challenges. Some research is done about relationships between e-business, KM, CRM and SCM, but none of them focuses on the oil and gas industry, because oil and gas markets are unique and different from other markets with respects to their specific features and structures (it will be explained in the literature chapter) and linking it to the economy of countries. As a result, this research can contribute to the efficiency, effectiveness and productivity in the oil and gas companies by considering KM strategy and e-business strategy when they integrate and interrelate with different activities of this industry.

Therefore, a comprehensive research on e-business strategy and the role of KM in developing and implementing it, with a view to integrate e-business strategy with KM strategy, in the oil and gas industry, is the focus of this research. How e-business strategies and KM strategies are interrelated, what factors determine the effectiveness and success of each of the strategies, and how these factors interact in the overall success of the organisation to become a modern KBO are the questions the research seeks answers for.

Research Questions

The literature shows some extensive works on relationships between IT, business model, business strategy, e-business, KM, and KM strategy. However, a focus on strategies to become KBO, and its relationship with organisation's e-business strategy is not addressed well in the existing works. Particularly, such study in the strategic industry of oil and gas is missing. As such this research aims to contribute to the subject knowledge by extending the literature on theoretical and practical aspects of interrelationships between the two sets of strategies (knowledge and e-business), and also developing an appropriate e-business strategy model for establishing KBO in the oil and gas industry. Therefore, the main research questions are:

- How are e-business strategies and KM strategies interrelated?

  o Whether organisations' strategies in each domain impact on the other and how?

  o What factors determine the effectiveness and success of each of the strategies and how do these factors interact in the overall success of the organisation to become a modern KBO?

- How should e-business and KM strategies be (co-) devised/developed or integrated to achieve better results?

  o How should the oil and gas industry's characteristics be addressed in doing so?

Research Objectives

Primarily, the research aims to contribute to the subject knowledge by extending the literature on theoretical and practical aspects of interrelationships between the two sets of strategies (KM and e-business) for establishing KBO in the oil and gas industry.

In specific terms the research aims to achieve the following objectives are determined to be:

- Understanding and extending the role of KM theories, models and methodologies in the development and implementation of e-business, and how these two are interrelated.

- Exploring how the strategic industry of oil and gas as can be positively impacted by application of KBO empowered by KM and e-business systems in the countries with oil-based economy.

    o Hence exploring specific requirements for the industry in the design and implementation of KBO initiatives integrated with KM and e-business models and systems.

- Identifying components of KBO for supporting KM and e-business strategies

    o Identifying the effects of KM and e-business strategies and systems on developing KBO

- Exploring existing models and identifying the appropriate KBO approach/model in the oil and gas industry.

    o What components of KM and e-business strategy models support the development of KBO in the oil and gas industry?

Methodology

This study aims to conduct an exploratory study of knowledge management practices and e-business systems across a range of energy companies. The study employs a qualitative research method for the investigation of the research problem which corresponds with the interpretivism paradigm. Therefore, a qualitative research methodology was designed and methods including case study and interviews were used to collect data with a semi-structure questionnaire supported by secondary data. An expert panel was also formed of seven academic and professional experts in the Iranian oil and gas industry. The outcomes from the panel were selection of the cases studies (NIOC and NIGC and their subsidiaries (31 SBUs and companies) based on the Bain model), validation of the research model and the questionnaire based on method of CVI (the index of content validity), and a final review of the results. The research results were analysed using Nvivo.

The field for undertaking this research is the oil and gas industry in the developing country of Iran, and in particular NIOC and NIGC. Apart from technology, especially in the Middle East where a huge body of oil and gas companies exists, organisational cultures are almost similar. National Iranian Oil Company (NIOC) and National Iranian Gas Company (NIGC) were selected in this country, because Iran is an oil-based economy in the Middle East and is one of owners the biggest oil and gas reservoirs in the world.

Research Process

The task of research is normally defined as a sequential procedure concerning a number of clearly defined stages. It does not really require every stage to be concluded prior to continuing on to the subsequent one. At times stages are removed from the succession if two or more are operated simultaneously, and some may be completely excluded altogether. Figure 1-1 illustrates the process of doing this research. Previously, the research problem, objectives, questions, the literature review and the conceptual framework were mentioned. Here, the main discussion is how to do the conceptual reproduction in line with the aims of the research and questions. In this part, the research context, the population size, the data collection methods, the research instrument, limitations and timetable are explained.
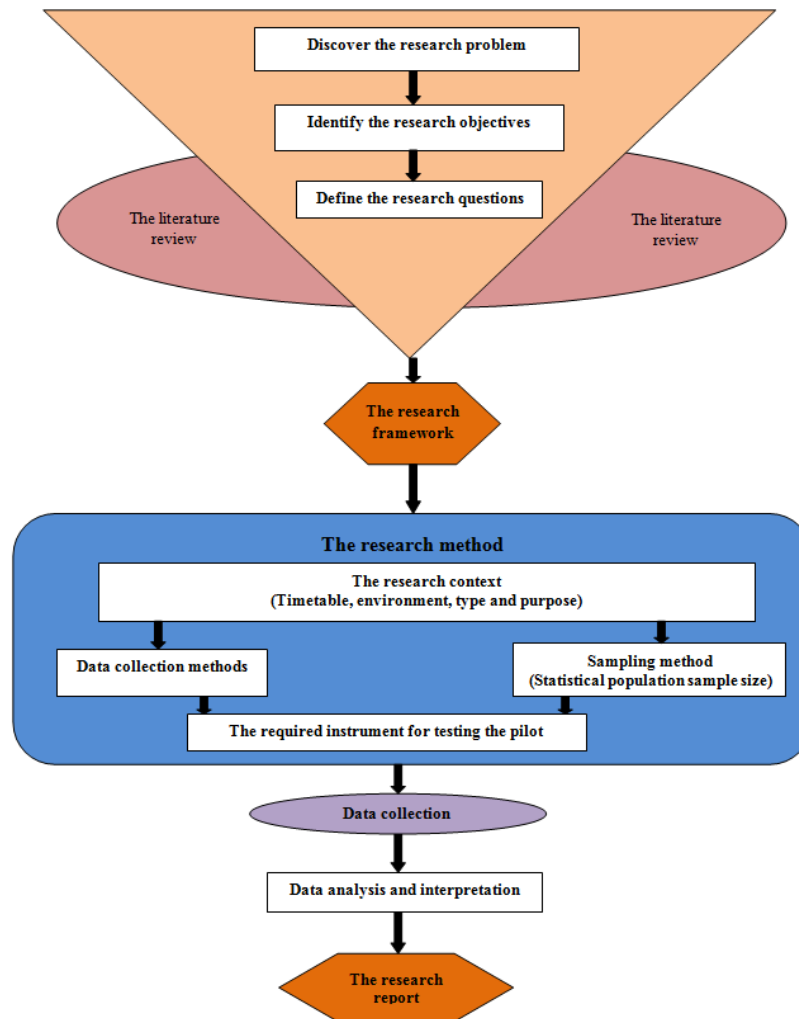
Figure 1-1: The Research Process

Thesis Overview

The thesis has six chapters including:

- Chapter 1 explains the importance of the research, problem definition, questions and objectives of the research.

- Chapter 2 is the literature review which focuses on KM, e-business models and strategies, KBO models and their components. Also, it mentions technology and modern organisations models and theories and innovation, organisational learning, agility, absorptive capacity, value chain and resilience and their roles in KM and e-business in organisation.

- Chapter 3 presents the conceptual framework of the research. KM, e-business and KBO models which are designed based on the literature review and also a research model designs with respects to the research framework. Finally, the core questions and propositions are designed for the study.

- Chapter 4 discusses the methodology of the study which includes research paradigm, tools of data collection, ethical issues and context of the research.

- Chapter 5 is the data analysis method of the research and discussion of the results and implications.

- Chapter 6 explains the research summary, research discussion, research limitations, contribution to knowledge and future research opportunities.

CHAPTER 2: LITERATURE REVIEW

Introduction

The main approach of this chapter is to conduct a comprehensive literature review in order to build a theoretical platform to first understand KM and e-business strategies and models effectively enhance these strategies. This literature explains a concise outline of knowledge management, emphasising several main features of knowledge within any organisational environment and illustrating some common method of KM. It focuses on information systems, modern organisation and the organisational features of knowledge-based organisation (KBO); the manner in which people and groups work together to acquire and utilise knowledge. Then, I highlight some main features of e-business, e-business strategy and several business matters they result in for any organisation. Finally, the strategic capabilities and organisational performance and their relationships with KM and e-business will be discussed as the most important concern for business organisations.

Knowledge; An Evolving Concept

Product-based organisations can focus on their technology and market-based organisations on their customers in a fairly limited and linear fashion (Buckman, 2004). Becoming a knowledge-based organisation, by contrast, requires a vast increase in the function of knowledge within the strategy of the business. Increasingly, organisations will be using knowledge to differentiate themselves from their competition.

Whether that knowledge is used to create products or services, whether it is used to improve a manufacturing process, whether it is used to understand competitors, whether it is used to address the issues of a customer or to fulfil a requirement, knowledge will comprise the differentiating factor for the successful organisation. Static knowledge won't count. It is through the movement of that knowledge that an organisation will create value (Buckman, 2004).

The whole focus should be on the front line with the customers' needs, because this is where the money flows in. All the other departments must learn to track and support that relationship if the organisation is to be successful. Knowledge needs will shift over time as customers' needs change; everyone must stay alert to that and watch for ways to respond, pursuing customer satisfaction like independent entrepreneurs (Buckman, 2004). In addition, knowledge needs to grow and change with changing capabilities throughout the organisation, providing opportunities and requirements in areas that the customers couldn't imagine but that are

essential to long-term customer satisfaction. In modern organisations, the basic ability to handle information and knowledge is changing for the better every day. To take advantage of these improvements, it is essential to push the development of knowledge systems that will help redefine the time equation of work (Buckman, 2004).

In today's highly competitive business environment, firms have to utilise their proficiencies to acquire the biggest competitive advantage (Spender, 1996). Through formation and sustaining of competitive advantages, organisations are establishing effective processes to manage knowledge (Liao et al., 2008).

Explicit and Tacit Knowledge

Nonaka (1995) recognises two kinds of knowledge. Explicit knowledge comprises a scientific rule, that may be validated from the initial principles. Due to its foundation and origins being recognised, this kind of knowledge is easy to transfer, inside and outside an organisation and between individuals. Contrarily, tacit knowledge comprises a experiential rule, acquired empirically and maintained by the staff of the organisation and embedded within long-maintained practices. Tacit knowledge is therefore harder to oppose, a challenge to transfer and more simply lost to an organisation (Beckett, 2000). The knowledge creation must be carried out using all four processes of converting knowledge and their particular methods (Table 2-1): Socialisation, externalisation, combination and internalisation (Neagu, 2008).

Conversion	Methods
Socialisation	a) Apprenticeship; b) Shared experiences; c) On-the-job training; d) Point activities; e) Physical proximity; f) Walking in the company; g) Informal meetings outside the workplace; h) Wandering outside the company
Externalisation	a) Use of metaphors and analogies; b) Dialogue; c) Self-reflection
Combination	a) Use different data sources; b) Meetings and telephone conversations; c) Presentations; d) Using ICTs
Internalisation	a) Learning-by-doing; b) Focused training with senior colleagues; c) Simulation/experiments; d) Self-reflection upon documents; e) Reflection with others

Table 2-1: Knowledge creation and its methods (Neagu, 2008)

The organisation's ability to develop knowledge is reliant on two aspects; its uniqueness of availability of knowledge and its availability to the necessary technology for development. In instances in which one of the aspects is positive and the other still has no value, the knowledge may be co-developed or sold in collaboration with another organisation which has the absent feature (Beckett, 2000).

Knowledge Management

Knowledge management comprises "the planning, organising, motivating and controlling of individuals, systems and processes within the organisation to make sure that its assets which are knowledge-associated are enhanced and efficiently utilised" (King, 2009). The KM processes encompass the knowledge creation, acquisition, improvement, storage, transformation, dissemination and exploitation. The function of KM operates these processes and improves systems and methodologies to support them, and encourages individuals to participate in them. The KM objectives comprise the leveraging and enhancement of the knowledge assets of the organisation to effectuate improved knowledge processes, enhanced organisational behaviours, improved resolutions and improved organisational performance (King, 2009).

Gupta et al. (2000) describe knowledge management as "a process which assists organisations to find, select, organise, distribute and transfer information and capability to support required activities like decision making, strategic planning, learning and problem solving inside the organisation". Knowledge management is additionally acknowledged as an activity which supports the production, development, implementation and maintainability of intellectual capital within organisations; intellectual capital being described as the collective knowledge, proficiency, experience as well as related intangible assets (Jelavic, 2011).

Knowledge management is related to acquiring and employing every bit of the information inside an organisation, which enables people to implement suitable knowledge and information to what is previously known, to form new knowledge (Gao et al., 2008). The main point is the formation of structures which combine the most progressed aspects of information resources, essential contribution of human response, as well as decision making (Raisinghani, 2000).

Wilson and Asay (1999) describe knowledge management as a process that provides rapid availability of expertise and information all through the entire system as required to improve organisation performance and organisational learning. With this being mentioned, organisations require to establish the capability to manage available knowledge and build new knowledge which favourably places them within the selected markets to become competitive (Niu, 2010).

Buckman (2004) states "KM comprises the systematic approach to assist knowledge and information emerges and flow to the right individuals at the right time to create value". The knowledge sharing and communication are human nature. The manner in which the participants of a group cooperate and share resources among themselves to be successful on their own as well as collectively will establish how rapidly and how entirely they may redefine the equation comparative to competition. People are individually all susceptible to defeat. Together, a group

can succeed if it functions in collaboration efficiently and smoothly. It is crucial to harness the thoughts of the organisation in order for them to collaborate to address customer requirements anywhere and at any time. This is the strongest compulsion that can be held by any organisation within the current environment. Confucius was quoted as stating that true knowledge comprises "To know that we know what we know and that we do not know what we do not know, that is true knowledge" (Buckman, 2004).

Plessis and Boon (2004) define knowledge management as "a structured and planned approach for managing the acquisition, sharing, gathering, utilisation and influencing of knowledge as an asset of the organisation, to improve the capability, rapidity and efficiency of the companies in providing services or products to the advantage of customers, congruent with its business strategy. Knowledge management occurs on three levels, specifically the individual, team and organisational levels. Additionally, knowledge management deals with the management of explicit as well as tacit knowledge, in which tacit knowledge most likely comprises the area of most influence. It comprises a holistic resolution including a range of views, specifically individuals, process, culture as well as technology views, which all have equivalent weighting in management of knowledge. (Plessis and Boon, 2004).

Malhotra (2001) defines knowledge management as comprising a process that addresses the essential matters of organisational competence, adaption as well as survival in view of growingly discontinuous environmental changes. Basically, it involves organisational processes that look for synergistic integration of data and information processing capability of information technologies, in addition to the innovative and creative capacity of people (Warkentin et al., 2001).

Numerous techniques of KM have been developed and implemented by firms to gather people to create, share as well as utilise knowledge. Several KM methods utilise suitably instituted methods of effecting transformation in the manner in which individuals perceive and comprehend their organisational and competitive setting, like training, mentoring and development. Others have progressed particularly with the creation of knowledge and employment as their concentration point, like knowledge mapping, collaboration, storytelling, and communities of practice (Fahey et al. 2001).

Some organisations are following efforts to expand this setting to enhance communications with external stakeholders, including customers, suppliers and business partners. Some of the aspects which considerably impact the success of a knowledge management inside an organisation comprise (Warkentin et al., 2001): Providing timely and efficient availability to utlise knowledge at all levels so as to realise the competitive advantages and efficiencies; Sending the

varied members (comprising expert experiences and skills) of the organisational units into a knowledge work community; and finally, providing evidence and knowledge based decision making to enhance the standard and timeliness of the decisions created (Offsey, 1997).

A progressively more refined comprehension of the knowledge phenomenon, embodied in what could be marked as knowledge principles, underlies the debate as well as the implementation of these objectives and foci. These principles emphasise, for instance, that KM go a great way past planning and implementation of the instruments and technologies included in collecting, analysing, and transferring data. Instead, KM focuses on people and groups as the formers and utilisers of knowledge. It embodies the main function in establishing deep comprehension from just data and information. Creating and employing knowledge comprises a human effort: it necessitates people to reflect and rationalise. In brief, it make sense of the present and appearing world surrounding them (Fahey et al., 2001).

Knowledge Management Strategy

Knowledge strategy is described as the set of beliefs and guidelines which form an organisation's utilisation of knowledge (Kasten, 2006). These utilisations could encompass but are not restricted to, recognition, development, management, storage, retrieval, exploitation and disposal. A knowledge strategy, as an aspect of the business strategy, provides a connection linking the strategic decision of the organisation as well as its knowledge activities and structures. Bierly (2000) have a similar viewpoint to knowledge strategy when he described four fundamental derivers concerned in the formation of a knowledge strategy: internally vs. externally collected knowledge, enhanced vs. new knowledge, slow vs. fast speed of learning, and breadth vs. depth of knowledge base. Using these aspects, Bierly (2000) suggests four general knowledge strategies: passive learner, imitator, exploiter and explorer.

On the other hand, every strategy of knowledge management planned to enhance organisation performance has to deal with three aspects (Figure 2-1): 1) the work activities or processes which create and utilise organisational knowledge; 2) a technology structure to support knowledge acquisition, distribution and utilisation; and 3) behavioural norms and practices usually named "organisational culture", which are fundamental to efficient employment of knowledge (De long, 1997).

Generally, knowledge strategy has been acknowledges as one from three meanings employed for KM strategy, with a concentration on knowledge- based competitive advantage vs. either a

approach of KM or the application of KM (Saito et al., 2007). KM makes a portfolio of techniques and procedures employed to acquire the most from a company's knowledge assets (Teece, 2000). Although KM strategy addresses technical and structural management matters, knowledge strategy addresses business outcomes and reinforcement for competitive advantage. For instance, Zack's (1999) knowledge strategies of exploration and exploitation concentrate on the implementation of knowledge inside the company, while Hansen et al.'s (1999) KM strategies of personalization and codification concentrate on the structuring of knowledge inside the company (Denford and Chan 2011).
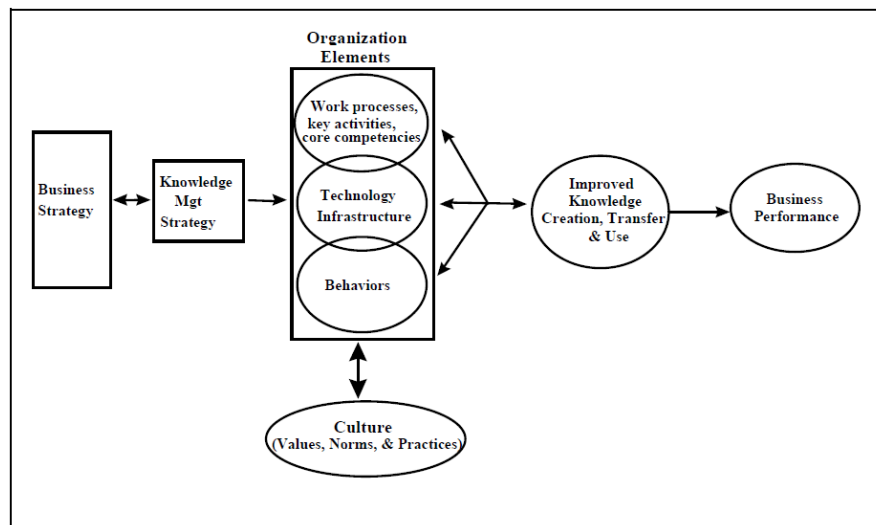
Figure 2-1: An overview of knowledge management elements (De long, 1997)

Beckett et al (2000) explain that KM strategies are placed in three categories, signifying those changes signified in the DIKT (Data, Information , Knowledge and Technology) model offering sustainable competitive advantage. These comprise knowledge acquisition, retention and exploitation.

Figure 2-2 illustrates that development of knowledge for sustainable competitive advantage concerns some transformational processes, such as data analysis and communication of information. These processes should be managed, and thus necessitate a strategy to direct them which is coherent with the organisation's mission (Beckett et al., 2000).

Mission → KM Strategy → KM Processes → Capital (Technologies)

KM Processes → Labour (Expertise)

Mission → Knowledge Definition

KM Processes → Techniques
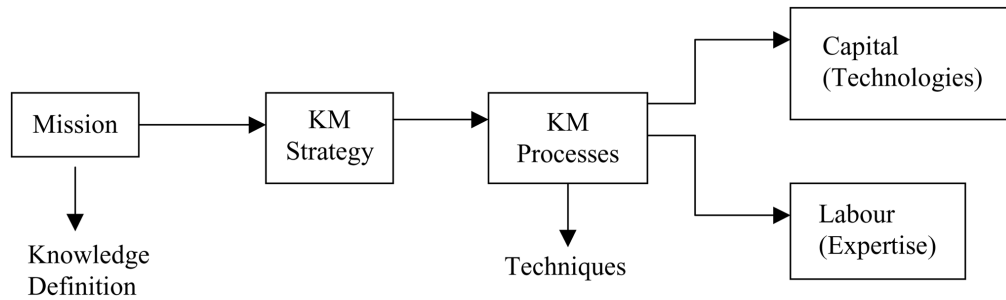
Figure 2-2: Formation of strategy and processes (Beckett et al., 2000)

Warkentin et al. (2001) believe that organisations should create knowledge networks to improve their strategic planning and decision making; and operational effectiveness and efficiency. In fact, knowledge networks are platform for knowledge management strategy. They can facilitate to create, share and employ knowledge in organisation and exchange tacit and explicit knowledge between people, groups and organisation.

Knowledge Management and Communication

The process of knowledge creation within an organisation is viewed as a dynamic communication between knowledge and knowing at the social and individual level, within which new knowledge is produced inside the process founded on a person's social learning and insight (Cook and Brown, 1999). This process is constituted of the four unique processes of socialisation, externalisation, internalisation and combination which are carried out within a community of practices or micro-community (Nonaka and Takeuchi, 1995). New knowledge which is formed within the process of knowledge creation then requires storage for subsequent use as an organisational memory. The process of knowledge storage concerns finding ways of changing human insights, documents, models and other artefacts into states that render extraction and movement simple although maintaining the true meaning of the knowledge (Staples et al., 2001). Using information technology, organisations attempt to establish great repositories of organisational knowledge regarding processes, customers, projects, suppliers, technology, industry, competition as well as the organisation's knowledge of itself. Knowledge diffusion or transfer takes place at different levels of an organisation, for instance between people, between people and groups and between groups and the organisation, and between organisations (Alavi and Leidner, 2001). If knowledge is regarded as autonomous phenomena from the setting within which it is generated or employed, then it may be stated that an

organisation should attempt to transfer the right knowledge at the right time to the positions it is required. In the absence of application of knowledge, all the previously stated processes are worthless. Only the application of knowledge can make sure that the organisational knowledge signifies a viable origin of competitive advantage. To be worthy to the stakeholders of the organisation, disposable knowledge must be transferred within a reduced expense structure, a greater flow of revenue or both (Biloslavo, 2005).

Trust in Knowledge Management

Some researchers are of the opinion that knowledge-sharing comprises a kind of social dealing between people as a result of the fact that efficient sharing of knowledge is individual-based, as opposed to people-based (Riege, 2005). This is why it is essential for organisations to capture the minds, thoughts as well as behaviour of its staff taking into account that knowledge sharing does actually necessitate a culture which enables workers to share knowledge as an aspect of their everyday work activities. The key objective of efficient knowledge-sharing as stated by Buckman (1999) comprises concentrating on the most essential requirements of an organisation; ensuring that the structure should support strategy; Ensuring that the organisation creates trust through stressing basic virtues as opposed to principles; disseminating knowledge and implementing best practices; sorting problems of customers speedily; permitting associates to deal with the problems they experience with no intrusion by the management; infusing customers feedbacks into the development process of new products (Buckman,1999).

Consequently, businesses should form a wish to share as a directing value in organisational survival. Thus, the unresolved matter of trust still remains (Riegem 2005) , which is debatably one of the more essential aspects for success in forming a culture which shares knowledge (Tan et al., 2009). Apparently, the symptom of lack of trust, as stated by Riege (2005), commences from the trustee or the trustor (knowledge participants). Riege also stated that an absence of trust is apparent in two different states: (1) trustee due to abuse of knowledge or receiving undeserved credit for it; or (2) creditably and accuracy of the knowledge which is taken from the trustor. Thus, the worth and promotion for sharing of knowledge by organisations truly necessitates the formation of a culture of trust (Lengnick-Hall et al., 2003)., within which staff will be additionally open to sharing their knowledge within a trusting environment (Davenport and Prusak, 2000; Fairholm and Fairholm, 2000; Faraj and Wasko, 2001; Leana and van Buren, 1999; Robertson and Hammersley, 2000; Settoon and Mossholderb, 2002). As expected, the trust culture within a workplace does comprise a strong and robust impact that function as a significant compulsion supporting the sharing of knowledge (Tan et al., 2009). Comparably,

Hsu and Huang (2005) both proposed that trust truly has to be instituted between employee-to-employee communications in promoting a culture of sharing; progressing into a 'knowledge-oriented culture' (Ling, 2011).

Knowledge Management Systems (KMS)

KM systems refer to a category of information systems implemented to the control of organisational knowledge. That is, they comprise IT-based structures established to improve and support the organisational process of knowledge acquisition, storage, dissemination, and exploitation. Although not all KM efforts include an application of IT, and warns against an emphasis on IT to the detriment of the cultural and social aspects are not rare (Davenport and Prusak, 1998), numerous KM efforts are dependent on IT as a significant enabler. Although IT is not implemented in all matters of knowledge management, it can support knowledge management in various ways. Instances comprise finding a documented origin of knowledge employing online directories and searching databases; disseminating knowledge and collaborating in virtual groups; availability of information regarding previous tasks; and learning about customer requirements and behaviour by analysing transaction information between others (KPMG, 1998). There is truly no single function of IT within knowledge management as there is no sole technology constituting KMS (Alavi and Leidner, 2001).

KMS comprise application of the organisation's information systems and computer-based communications to support the different processes of KM (King, 2009). Generally, they are not technologically different from information systems and the communications, but concern databases like lessons learned stores, and systems and directories like those planned to place organisational members in contact with acknowledged experts in a range of topic areas. A main variation between many KM systems as well as information systems and the communications of the organisation is that the KMS can be less automated in that they could necessitate human activity within their operations. Although information systems normally necessitate that people make selections within the design stage and then function automatically, KMS occasionally include human involvement in the participation phase. For example, following the planning of a sales database, individuals should decide on its structure and content. Following the creation of a lessons learned store of knowledge, individuals should all make similar design selections, but they additionally should take part in its operational stage as every unit of knowledge which is provided for inclusion is special and should be appraised for its important and relevance (King, 2009).

Oil and Gas Industry; Features and Structure

Knowing some basic principles of the oil and gas industry help to understand better it in the research. The industry has been explained with two views; features and structure (Levine et al., 2014).

Some outstanding features of the industry include:

- The price of the crude oil is determined based on supply and demand factors (Kilian and Park, 2009). Therefore, conflict in the Middle East and the most important countries, which produce the crude oil, influence supply and demand of it and also its price in the world (Tétreault, 2011). Furthermore, the price of crude oil has affected the economy of countries, because it is a main energy sources for the industries such as power plants, transportations, etc. (Jiménez-Rodríguez and Sánchez, 2005). It means that increasing the crude oil prices led to raise the prices of other energies, such as electricity and petrol. Therefore, the crude oil price can affect the life of people indirectly, while finding a product such as the crude oil that has such an impact on people's lives is difficult.

- Markets of the crude oil and oil products are divided into two markets; spot and future markets (Pindyck, 2001). The spot markets refer to transactions, which involve in business of the crude oil and the oil products for near-term delivery for instance a contract that signed this month, but delivery will be next month (Kaufmann, 2011). In contrast, in the future markets, the crude oil traders sign a contract this month and specify the type, price, grade and volume of crude oil, particular location to which it is delivered and the future time in which the oil is bought or sold (Silvapulle and Moosa, 1999). With respects to condition of the oil markets, which have faced with continuous and numerous changes in prices, consequently buyers prefer to purchase it in the future market that can decrease risk of the price increase in the future (Fattouh et al., 2012). While markets of other products and commodities have few changes in their prices.

- There are three primary benchmarks that the oil prices are pegged to one of them (Reboredo, 2011);

  - Brent Blend: Almost two-third of all oil contracts reference Brent Blend around the world. It is related to four different fields in the North Sea: Brent, Oseberg, Ekofisk and Forties. The oil quality of this region is sweet and light; and is ideal for the refining of petrol, diesel and other high-demand products.

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- West Texas Intermediate (WTI): WTI is related to the US wells. It is sweet and light, ideal for petrol and diesel refining, but expensive to ship to other parts of the world. It usually consumes in the US.

- Dubai/Oman: it is a useful reference for the Middle Eastern oil that its grade slightly lower than Brent or WTI. The main reference of Persian Gulf Crude oils for delivering to the Asian market is this benchmark.

- The grade and type of crude oils are different and oil refineries and equipment are designed and made based on them (Gary et al., 2007). Therefore, the oil buyers cannot change their type and grade of the crude oil easily.

- The crude oil divided into two kinds, heavy and light (Fattouh, 2010). The light crude oil is traded in upper prices rather than the heavy. Because the heavy crude oil needs to be refined more and consequently the cost of the oil companies will increased.

- The oil and gas companies are categorised into two groups (Pirog, 2007); National Oil Companies (NOCs) for instance NIOC (Iran), Saudi Aramco (Saudi Arabia) and PDVSA (Venezuela); and International Oil Companies (IOC) for example BP, Shell and Exxon Mobil. The NOCs are owners of the crude oil and gas reservoirs, but the IOCs have technologies of processes to explore, develop, produce and distribute the crude oil and gas (Stevens, 2008). Therefore, the two groups companies have a close interrelationship for carrying out the oil and gas projects.

- The oil and gas companies are competing, while the kind of competition is different (Van der Linde, 2012). For instance, there is not an outstanding differentiation in quality of produced petrol in an oil refinery and produced petrol from other companies. The quality of the oil and gas products and the applied technologies for decreasing prices of the products are the main factors in the competition in this industry (Mitchell et al., 2012). For instance, when a driver stops to fill the fuel tank of the car, they never ask about the petrol producer and just check the price.

The structure of the oil and gas industry divided into three sectors (Devold, 2013):

- Upstream: this sector includes exploration and development of the oil and gas fields.

- Mid-stream: it includes refining and processing operations of the crude oil and gas, transportation of them through tankers, pipelines, rail and trucks; storage of the oil and

gas to facilitate distribution and finally, technological applications for improving effectiveness and efficiency of the oil and gas processes and activities.

- Downstream: the last sector is storage, distribution and sale of Gas (LNG, CNG and GTL) and Oil products (Petrol, Diesel, etc.).

All the oil and gas companies are working out in one or more the above sectors and their required technologies (equipment and systems) are different with regards to type of activities in these sectors.

Knowledge Management in Oil and Gas Industry

The natural resources, human resource and technology are three main factors in the oil and gas industry (Ramos and Veiga, 2011). Change on these factors can affect planning, operations and production of the industry. They should be managed by skilled individuals and groups, which analyse, share experience, knowledge and knowhow. On the other hand, knowledge management as a competitive advantage can help them to improve their competencies and to manage their activities and processes (Ndlela and Toit, 2001). Therefore, knowledge and information management are key strategy for the oil and gas industry. The knowledge of managers and experts especially when they are retiring, if not planned appropriately, it causes to a knowledge loss or make a knowledge gap in the industry (Cong and Pandya, 2003).

The gas and oil industry has made the most of knowledge management (KM) advancements for over two decades (Leavitt, 2002). Within that period, the oil and gas industry has experienced rapid changes and numerous mergers to the extent that a petroleum firm bearing a one-worded name is rare. All through the rapid progress of technology, an expansion of drilling offshore, several acquisitions, the increasing dependence on international supplies of oil, and a focus on issues of environmental, KM efforts have had a role in rendering activities additionally effective and efficient (Hvozdyk and Mercer-Blackman, 2010). For example, when gas and oil companies have had to deal with new technology, outsourcing, new partnerships, as well as regulations of government, their KM teams have offered support by means of transfer of technology and knowledge, in addition to management of assets (Ordoñez de Pablos, 2014).

The oil and gas companies are competing in this industry. But, there is not a special differentiation in products in this industry (Shafiwu and Mohammed, 2013). For example, a quality of a tank of petrol from one refinery (BP) is no different from other refinery (Shell).

Here, the price is important for customer. Therefore, the companies are not really competing on product nor do they compete on technology. The rivalry concerns the implementation of technology and the employment of knowledge at right place, at right time through right people in right way (Milton, 2009).

Therefore, a technology-driven industry like the oil and gas needs to be managed and utilised efficiently and effectively to compete in the world through making a sustainable competitive advantage (Reece et al., 2008). Consequently, knowledge management can have a key role to manage internal and external environmental factors for the oil and gas companies.

Knowledge and information management is crucial for the industry of upstream and downstream oil and gas (Leavitt, 2002). Key staff in the industry, especially in Iran, are retiring in imminent years, which, if not controlled adequately, could result in a gap in knowledge within the industry. Economic circumstances are still challenging, signifying that firms will have to scrutinize means of employing their information to increase their corporate returns. For a long time BP has been acknowledged as a pioneer of the gas and oil industry regarding KM (Shuen et al., 2014). However, since the Mexico Gulf catastrophe, there are several that have speculated that matters with KM could have had a role in the incident.

Despite these assertions being true or otherwise, Mick Milton, mentions that an objective for KM will be to ensure that whatever took place never occurs again at any point to anyone and anywhere (Milton et al., 2012). Dr Ivor R Ellul, Knowledge Reservoir's CEO, which is a company that consults for the oil and gas industry, is convinced that following the exponential development in technology, there is no reason for enterprises of any magnitude to not apply a KM strategy. The firm recently declared the establishment of a new service which permits participants of the gas and oil industry to establish WikiPortals. Of late the WikiPortal has been implemented by a globally integrated energy firm from Texas, to maintain a movable database of reservoir engineering methods. Primary content is developed by engineering and geosciences experts, prior to being added to and altered with time by participants within the wiki society. Ellul clarifies that the end result for the company's customers comprises enhanced information and smarter resolutions, from the viewpoint of an organisational knowledge capture as well as a support to educating a transitioning staff. Satisfying the requirement for additional information after the Gulf of Mexico incident, the firm is additionally considering inclusion of wiki pages within its Reservoir KB source book, which comprises data covering nearly 290 fields (Ellul et al., 2014).

Some leaders of oil and gas industry have incorporated KM (Leavitt, 2002):

Ken Derr (Chevron Company): "We realised that we could utilise the knowledge to drive improvement and learning in our firm. We stress shopping for external knowledge to our company as opposed to attempting to create everything on our own. Each day that an improved idea is wasted is a lost chance. We need to share more, and in a faster way."

John Browne (BP Company): "Every firm encounters a common obstacle: employing knowledge more efficiently compared to their rivals."

Brendan O'Neill (Imperial Chemicals Industries): "Knowledge management comprises the structure for creativity to thrive within the new business while adjusting staff to the rapidly altering operating setting."

Rudulfo Prieto (PDVSA Company): "We became involved with KM as we had numerous projects in progress that it was a challenge to regulate without restricting innovation....Using KM, various leaders share experience and knowledge in addition to progressing to form what I refer to as 'contamination centres' where individuals infect one another with ideas."

D.E. Baird (Schlumberger Company): "We have to become professionals in acquiring knowledge, combining and conserving it, and then making what has been learned swiftly and simply accessible to any individual that will be concerned in the following business decision."

Oil and Gas Industry in Iran

Iran has the world's fourth largest proven oil reserves and the second largest natural gas reserves (EIA report, 2015). Also, Iran is among top ten oil producers (almost 3.4 million barrels per day in 2014) and top ten natural gas producers (estimated 5.7 trillion cubic feet in 2013) in the world (EIA report, 2015). Revenue of oil and natural gas export of Iran is $118 billion per year (IMF report, 2014).

Iran discovered the oil in 1908 as the first country in the Persian Gulf (Mohamedi, 2010). The primary industry of Iran has been petroleum since the 1920s (Sepahy et al., 2005). Iran has tried to diversify the economy, but the engine of economic growth of Iran is still the oil and gas industry.

Responsibility of all upstream oil and gas projects is with the National Iranian Oil Company (NIOC) in Iran and it is a state-owned company (NIOC report, 2015). The constitution of Iran forbids private or foreign ownership of natural sources; but, international oil companies can

participate in the development and exploration phases through contracts of buyback (NIOC report, 2015).

The four main oil and gas companies manage and control all oil and gas activities in Iran. National Iranian Oil Company (NIOC) leads oil and gas upstream activities. National Iranian Gas Company (NIGC) manages natural gas downstream projects and activities. Objective of the company is to process and distribute gas for domestic consumption. National Iranian Oil Refinery and Distribution Company (NIORDC) is responsible for all downstream oil activities. National Petrochemical Company (NPC) operates and manages several petrochemical factories and complexes (Iran exports 13 million tons petrochemical products annually (EIA report, 2015)).

NIOC and NIGC and their subsidiaries and activities will be explained completely in the methodology chapter.

Knowledge Management Projects in Iranian Companies

The KM projects have been included in Iranian companies for two decades. KM is a new concept in the academic and industrial organisations in Iran. Most companies which implement KM are big and essential in Iran like energy, health, military and construction companies. Table 2-2 demonstrates some KM projects which have been implemented in the Iranian industry over the past few years. Objectives, outputs and outcomes from the projects are also clarified subsequently.

Company	Comments
The Industrial Development & Renovation Organisation of Iran (IDRO Group)	**Activity:** Comprehensive KM system **Objectives:** • Acquisition, evaluation, classification and Retrieval of the produced knowledge during working processes • Share the acquired knowledge in the organisation **Output:** KM system (software) **Results:** • Prevent from duplication in similar processes • Increase productivity of staff • Inform mangers from the acquired knowledge for using the organisational decisions

	Reference: Annual report of IDRO Group, 2013
Khatam-al-Anbya Construction Group	**Activity:** Documentation of projects' experiences **Objectives:** Implementation of KM in projects, Engineering of documents' knowledge, formulation of systems for documentation of projects **Output:** A KM software with a booklet for projects' experiences **Results:** • Make a database for integrating all of implemented projects • Access to different stages of projects and their processes • Identify Engineers and specialists of project for using other similar projects • Identify replacement time of parts or services for repair and maintenance **Reference:** KM report of Innovative Knowledge Company, 2012
Ministry of Health, Treatment and Education of Medicine	**Activity:** Knowledge Management and organisational experiences **Objectives:** • Possibility of collection, refinement, the sharing and assessment of the knowledge and experiences • Exploit the current knowledge and experience in different layers of organisation • Increase efficiency and effectiveness of organisation **Output:** Documentation of projects' experiences **Results:** • Integrate experiences of managers in Ministry of Health • Access to knowledge of doctors and experts in the medical field • Formulate modules for teaching to medical students • Up to date the latest methods which have been used by specialists and Iranian physicians for treating disease **Reference:** • Rayazeytoon, 2011 • www.rayazeytoon.com
Razi	**Activity:** Knowledge Management Master Plan **Objectives:** • Exchange of knowledge between organisational units • Use the experiences • specialists and managers for fresh staff • Prevent duplication in similar processes • Identification of experts in different levels in organisation

Petrochemical Company	Output:
	A comprehensive system for knowledge Exchange (MTA. Share)
	Results:
	• Implement a comprehensive system with a tree of Knowledge (MTA-Share 2.1)
	• Formulate a regular procedure for knowledge entry with use of 117 Knowledge Domain knowledge and more than 388 members
	• Access to knowledge bank with 48 input monthly and close to 288 primary students
	• Design a knowledge-based bank for rewarding to staff
	• Provide cultural processes like a booklet for distributed knowledge and Journal of catalyst
	Reference:
	KM activities report of Petrochemical companies in Iran, 2013

Table 2-2: Some KM projects implemented in Iran

Knowledge Management Projects in Multinational Oil and Gas Companies

Knowledge sharing between personnel and departments is a competitive advantage in the organisations. The multinational companies are always advanced in use of new technologies. Table 2-3 shows some big companies in the world which use KM in their activities. The results demonstrate that oil and gas companies saved millions of dollars in their costs when they approached and used KM.

Company	Comments
	Activity:
	Implementation of KM
	Objectives:
	• Share knowledge of staffs
	• Increase efficiency of BP
	Output:
BP	A KM system (software) to connect staffs
	Results:
	• Saving $50 million in drilling costs
	• Obtain a record of drilling in Oil Field "Schiehallion"
	• Producing over 800 valuable documents which are real wealth of BP
	• Saving $260 million in year costs of 1998
	• Providing solutions for problems by experts via video conference
	Reference:

	• SAIC Knowledge Management KM & British Petroleum A Historic Example of the SAIC KM Approach • Lord Browne, Major Projects Association Prestige Lecture, The Royal Society, June 2004 • KM & British Petroleum, A Historic Example of the SAIC KM Approach, www.saic.com/km/who
Chevron	**Activity:** Implementation of KM **Objectives:** • Reduce operational costs • improve performance in the world • change towards a strategic business **Output:** A software for increasing speed of documents' records and exchanges of information **Results:** • Saving $45 million in management costs annually • Improve efficiency and safety of personnel • Improve performance in commercial affairs **Reference:** • Chevron Press Release - Once An Obscure Discipline, Sep 2010 • Knowledge Management Is Now A Business Necessity • Managing Knowledge The Chevron Way, Sep 2010 • Paul Gray Crito Associate Claremont Graduate School ,Graduate school of management, January, 2000
Shell	**Activity:** A comprehensive KM system **Objectives:** • Increase productivity in training of personnel • Decrease the Knowledge gap between experienced and low background personnel **Output:** • Software of Company Shell is a KM tool box which have three parts: -Network of specific knowledge (SIGN) -Network of relationship with professionals and Meetings (Métis) -Encyclopaedia (shell wiki) -Network of critical knowledge (ROCK) **Results:** Saving $200 million in 2000 for examples: -to avoid digging a new well in consultation with experts -Use a drill bit with high accuracy and quality in result of consult with those who are similar had done. -Exchange of experiences among staff of Shell for saving electrical energy

	Reference:
	• Hendrix Donna, Focusing on Behaviours and learning at Shell, Knowledge management Review, Jul/Aug2007 • IBM - Shell fuels innovation and agility with asset management solution from IBM-report, 2008 • Knowledge Management for the New World of Business Report, 2009
Z Energy Company	**Activity:** Establishment of sub-KM for personnel **Objectives:** Discovery of potential employees for promotion, empowerment and efficiency **Output:** Use of software (lotus Notes Mail) to organize, calendar, write and also manage e-mails **Results:** Increase efficiency of personnel's training **Reference:** Chowdhury and Ahmed, 2005

Table 2-3: Examples of KM systems implemented in multinational oil and gas companies

The Emergence of Network economy, ICT Revolution and Social Engagement

Technology has constantly comprised a core element of organisational theory, informing study and application. In spite of years of explorative endeavour there is not much agreement on the measurement and definition of technology, as well as no convincing evidence on the exact function of technology within organisational matters. The concept of 'technology' is employed considerably broadly here. As well as the significance of "machines and sophisticated devices", technology additionally generally means the research of tasks or techniques (Perrow, 1979)

Yildiz (2007) clarifies that technology was considered as a way of controlling the restrictions of bounded-rationality and provide the infrastructure for improved decision making. Technology was shielded from the centre so as to control the uncertainty. This was required as technology and environments were viewed to comprise the two fundamental origins of uncertainty that oppose rationality within decision making of organisation. Additionally, as information technology (IT) was employed in the automation of backroom operations and enhancement of the effectiveness of clerical activities, government IT experts were separated from functional and executive oversight. Perrow (1967) argued that technology comprises an essential factor of the structure and the strategy of the organisations, which employ it. Technology has a reduced

function of influencing human objectives and selections, and is itself influenced by human objectives and selections (Heeks and Bailur, 2007).

Previous views of technology have each concentrated selectively on some features of technology to the expense of others, with the outcome that the present state of knowledge regarding technology in organisations is vague and contradictory (Barley, 1990). Two significant elements of the idea of technology comprise scope (what is described as constituting technology) and role (the description of interaction between organisations and technology) (Tassabehji, 2007). Each of these elements inform previous technological studies, where they have been employed and specified differently.

Two views of technology on the scope have permeated and influenced researches on technology, to reflect the different claims to generalisability that academics have aimed for with their works. The first group of studies has concentrated on technology as comprising hardware, that is, the machines, instruments and equipment that are used by people in productive operations, either informational or industrial devices (Zuboff, 1988). The variety of hardware between industries and organisations, nonetheless, has resulted in several, context-particular definitions of technology, which have restricted contrasts over researches and environments. For instance, Woodward's (1958) classification of technology as industrial manufacturing techniques is restricted to production companies. Instead, this technique has additionally caused the employment of broad definitions of technology which, having to encompass a broad variety of machinery, are rendered so intangible as to comprise restricted discriminatory or informational worth. For instance, the definition of technology from Blau et al. (1976) utilised in the office and factory is provided as the replacement of human labour with equipment.

From the hardware perspective, technology comprises a significant element only within those organisations that utilise machinery for their productive operations. This limitation urged researchers to attempt to generalise the scope of the technology element to include organisations like service companies and learning organisations. The idea of technology was therefore broadened to social technologies, thus encompassing the general knowledge, techniques and tasks employed when people become involved in any productive operations (Eveland, 1986). For instance, Perrow (1967) views organisations as comprising places in which raw materials are transferred, thereby describing what is done to raw materials and the manner in which it is carried out, as the technology of organisations, although Thompson (1967) features the work flow of various organisations regarding long-linked, intervening and rigorous technologies. Although practical, in that it permits technology to comprise a significant element within all organisations, and it acknowledges that more is included within technology apart from merely

the hardware, this general approach of technology results in boundary and measurement uncertainty (Mintzberg, 1979). It additionally disregards important information regarding the intervention in human operations by machines. That is, although benefit in generality, the capability have been lost to ask questions regarding the manner in which artefacts interact with human agents. By collecting technique, task, knowledge and instruments into a sole construct of technology, interaction amid these constituting elements and with people is disregarded (Perrow, 1983; Suchman and Wynn, 1984; Wynne, 1988).

In terms of the differences in the role of technology, three streams of technology study may be differentiated through their definitions of the functions embodied by technology within organisations, to reflect the theoretical opposition between subjective and objective spheres that has governed the social sciences (Bernstein 1978; Burrell and Morgan, 1979; Giddens, 1979). The initial work presumed technology to comprise an objective, external compulsion that would comprise (relatively) deterministic effects on organisational properties like structure. In comparison, a subsequent group of researchers concentrated on the human operation element of technology, viewing it more as a result of mutual interventions and interpretations. The third, and most current work on technology has regressed to a soft determinism in which technology is placed as an external compulsion comprising effects, but where these effects are regulated by human players and organisational settings. Therefore, the scope refers to hardware and the role talks about software in the organisations.

Information Communication Technology (ICT)

Processes of knowledge sharing may be differentiated not just by which processes of learning they support but additionally by the manner in which they can be supported by ICT (information communication technology) (Zack, 1999).

Support of knowledge retrieval is usually required when knowledge transfers between the individual and the organisation. Therefore, stored knowledge is more appropriate, for instance in databases, reports and knowledge bases (Zack, 1999). KM began from the viewpoints of creating expert and knowledge database systems and the organisation can shares knowledge between staff. Thus, ICT has a supportive role to exchange knowledge among people as electronic networks (Ciborra, 1996).

The knowledge creation needs to be supported by networks for facilitating, while the networks are less structured than knowledge sharing for reuse. Decision-making is usually hard as what

knowledge should be distributed between staff and what the consequence or the objective of networking should be in the organisation. Brown and Duguid (1991) defined the COPs as knowledge networks. In some cases, electronic communities and groupware technology can support the processes of knowledge creation. The theories of Nonaka and Takeuchi are essential for knowledge management but are unable to acknowledge the function of IT in facilitating the stream of knowledge, capturing, integrating and exploiting knowledge communities (Bernard and Tichkiewitch, 2008). Managing the IT infrastructure of KM comprises an essential success element for an organisation (Zangiski et al., 2013). In the current information-based community, most of the setting of an organisation is actually established through its IT infrastructure (Ammar-Khodja and Bernard 2008). Table 2-4 presents the principal objectives of knowledge sharing, the kinds of ICT application employed to support the knowledge-sharing activities, the kinds of learning, in addition to the different firms.

	Knowledge Retrieval	Knowledge Exchange	Knowledge Creation
Learning From	Organizational knowledge	Individual knowledge	Community knowledge
Main Purpose	Store dispersed collective knowledge to enhance individual learning	Prevent occurrence of knowledge gaps and redundancy	Combining knowledge to create new ideas and insights
ICT Support	Knowledge base	Networks	Communities
Companies Studied	Railways National Netherlands (NN) Postbank's call center	Cap Gemini IBM ING Barings Schiphol airport	Unilever R&D Stork Ministry of Housing

Table 2-4: Three types of knowledge sharing (Ackerman, 2003)

Knowledge Management and Information Technology (IT)

The significance of IT systems and instruments is the result of a number of elements; they allow a kind of data/information conversion or management (e.g. data acquisition, storage, organisation, transfer and archiving or extraction) (Edwards et al., 2005); they provide interpretable or interpreted data (Corso et al., 2003;) they assist in knowledge production (i.e. capturing, innovation and learning) (Alavi and Leidner, 2001); they provide a tool of recognising behaviours and patterns of plant system (EPRI, 2006); they acquire tacit knowledge in the state of decision logic or criteria (Gallivan et al., 2003); they can be practical support

devices for acquiring, presenting and tracking procedures, processes and the performance of work tasks (Feng et al., 2004-5); and ultimately, they can assist in maintaining and making accessible the different data and information regarding the great amount of regulations, limitations, patterns, directions, restrictions and circumstances necessary for secure and dependable plant operation (Haugh et al., 2004). IT additionally provides the capability to combine information and data from a number of sources. It can argued that these systems provide an extension of human ability for learning (creating and processing data), communication (interaction), memory (maintaining), sorting data (storing and filtering), and interpretation (analysis and visualisation). These features facilitate additionally efficient employment of tacit knowledge by enhancing the accessibility of contextual data and information. This increases significance by assisting in the construction of knowledge and making sense. It enables general understanding by providing the chance to form and utilise knowledge through integrating and synthesising available tacit and new contextual explicit knowledge. Clearly, it can be argued IT infrastructure also aids firms in achieving their goals (Grosbois and Kumar, 2009).

The use of IT for the management initiatives of organisational knowledge reveals three applications: 1) the dissemination and coding of best practices, 2) the formation of corporate knowledge directories, and 3) the formation of knowledge networks (Alavi and Leidner, 2001). One of the more general applications comprises internal benchmarking with the objective of transmission of internal best practices (KPMG 1998). For instance, an insurance firm was encountered to the commoditisation of its market and reducing revenues. The firm established that implementing the most suitable decision making experts by means of a new underwriting procedure supported by a system of knowledge management facilitated its progression into profitable niche markets and, thus, to raise revenue (Davenport and Prusak, 1998). An additional application of knowledge management comprises the formation of corporate directories, additionally called the mapping of internal knowledge. Due to considerable knowledge within an organisation being uncodified, mapping the internal knowledge management is essential (Ruggles, 1998). A third general application of KM systems comprises the formation of knowledge networks (Ruggles, 1998). For instance, when Chrysler rearranged from functional to platform-based organisational units, they speedily discovered that expertise would decline if the suspension specialists were able to interact with one another easily over platform types. Chrysler created Tech Cul, gathering individuals face-to-face and virtually to build and exchange their gathered knowledge in all of the specialty areas. In this instance, the endeavour of knowledge management was less concentrated on mapping knowledge or benchmarking than on gathering the experts together so that significant knowledge was divided and amplified. To provide online forums for discussion and communication could create

knowledge networks. Buckman Laboratories employs an online interactive forum on which user comments are looped in conversational pattern and indexed using date, author and topic. This has reportedly facilitated Buckman's reaction to the changing foundation of competition that has changed from just selling products to removing chemical treatment problems of customers (Zack, 1998). In another instance, Ford realised that simply by sharing knowledge, the development period for vehicles was decreased from 36 to 24 months, and by means of knowledge sharing with dealers, the delay in delivery decreased from 50 days to 15 days (Gazeau, 1998).

Information technology of KM enabler makes reference to the basic foundation of information technology which support and coordinates KM; for instance, knowledge platform, database and systems of integrated performance support and performance assessment management (Beckman, 1999). Thus, information technology facilitates search, access and extraction of data, and support communication and collaboration between the members of organisation. Essentially, it fundamentally embodies a range of functions to support the KM processes of an organisation (Alavi and Leidner, 2001; Lee and Hong, 2002; Wong, 2005). Knowledge management and information technology are linked very closely together, as both assist in the spread of structured knowledge vertically and horizontally inside the organisation. They additionally make utilising and searching knowledge considerably simpler. The objective for many companies comprises employing the progress in information technology so as to carry out knowledge management (Alavi and Leidner, 2001). Lin and Tseng (2005) suggest that organisations should have a suitably developed technology which is within reach and simple to leverage knowledge management. Davenport et al. (1998) are of the opinion that generally including knowledge management within the basic construction of information technology within the organisation forms a manageable setting so that knowledge is disseminated inside the organisation, assisting to ease its success. Additionally, Hendriks (1999), and Hedelin and Allwood (2002) have found that ICT has an immediate and indirect impact on the promotion of knowledge sharing, as it can perform a number of tasks to remove difficulties, suitable flow processes, provide channels of acquiring information, and recognise the location of knowledge seeker and carrier. When scrutinizing the required strategy for applying knowledge management within the city of Saint Louis, Smith et al. (2001) found that advanced IT can permit the sharing and transmission of data on varied platforms. Thus, ICT can be referred to as the hygiene aspect, as in its absence, sharing of knowledge can be hindered (Yeh et al., 2006).

Two fundamental elements of KM comprise people and the element of ICT. Jointly, they explain the foundation of argument between alleged technology and human-oriented researchers. Nonetheless, within the suggested structure the two are regarded as having

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equivalent significance. The cause for this state is that knowledge is inseparably associated with individuals; thus, an organisation is unable to form new knowledge in their absence. Alternatively, it is a challenge for an organisation (at times even impossible) to effectively utilise disposable knowledge in the absence of the right technology (Biloslavo, 2005).

ICT has made it feasible to conserve important explicit knowledge for the future and to share a substantial quantity of information unlimited by the restrictions of time and geography (Lesjak et al., 2003). For an organisation, this signifies a chance to vertically and horizontally combine data and task, and in this method to limit the extent of the transformation cycle. The cycle of transformation encompasses not just the conversion of tangible inputs into products and facilities, but additionally the conversion of intangible concepts and insights into tangible outputs. With respect for the assertion by Hamel and Prahalad (1995) that it is not the complete extent of knowledge held by a company that results in competitive advantage, but the speed with which it is disseminated inside the organisation (Biloslavo, 2005).

What particularly makes up effective and efficient knowledge management (KM) is still a greatly arguable subject. Writers like Chait (1999), Earl (2001), Gallagher and Hazlett (2000) and Kruger and Snyman (2005) stress that in addition to technological support, knowledge management additionally necessitates social involvement (Kruger and Johnson, 2009). Kruger and Snyman (2005) recognised a raised inter-reliance between KM, information management and ICT management, and assert that as a result of the cycle of converting data into information and information to knowledge, information and communication technology (ICT) structures are inclined to make KM feasible. Similar to this assertion, Kazimi et al. (2004) believe that "currently there is an increasing acknowledgement that institutions can acquire maturity in KM solely by means of a strong coexistence of technology, processes and individuals, thus making a path for KM achievement in the forthcoming years." Debatably, for knowledge to be managed adequately, organisations have to advance to the extent where they are capable of managing knowledge, information and ICT concurrently. In considering the idea of knowledge management, Wilson (2002) asserts that KM signifies various things for various firms and that some firms having attempted it have passed on to alternative things.

Considerable uncertainty around KM commenced from the sequence of changing data into information, and information to knowledge. Within the provision of information for KM, ICT structures are usually viewed as comprising KM structures. Kazimi et al. (2004) and Gallagher and Hazlett (2000) state that this dependence on technology is what caused the maturity of KM to be drawn from the Software Engineering Institute's Capability maturity Model. Thus, Gallagher and Hazlett (2000) censure KM maturity models, asserting that they "spend excess

effort in attempting to deal with technological issues," or may be "too uncertain and do not provide much regarding practical help," or insufficient "stress is put on culture and other management concerns".

Although present KM maturity think usually suggests "new" methods and software to support KM development, writers like Botha and Fouche rationalise that KM maturity additionally should deal with "softer" administrative and even strategic matters as well as technological issues. Kruger and Snyman (2007) assert that as KM encompassed more than just technology management by encompassing uncertain elements like communities, processes and culture there is a considerable amount of disillusionment around maturity of KM; concerning development in KM maturity, Kruger and Snyman (2005) rationalise that ICT and in particular information management are conditions for KM. The primary stages in KM maturity are thus rooted in technology where organisations advance to an extent at which they are able to know and manage what comprises information and data. At the end of these stages, organisations should be able to move data and information using ICT, all in support of business activities. The subsequent level of maturity necessitates recognition of the significance of KM as comprising an official role within the organisation, as well as a related compulsion to implant this recognition all through the organisation. Kruger and Snyman (2007) state that this concerns a deliberate dedication, particularly from business managers, to begin accepting KM efforts. The subsequent maturity level revolves around the capability to utilise as well as investigate the strength vested in KM and knowledge (create KM strategies). The core of this level of maturity is not just the capability to deliberately improve strategy creation, but to modernise KM procedures and processes too. When organisations are able to improve business and strategy through KM, Kruger and Snyman (2007) assert that the subsequent stage of evolution comprises the inclusion and employment of knowledge vested within the organisation's value chain and value chain partners. The main requirement for this level of maturity comprises the capability to surpass the limitations of the organisation (e.g. the capability not just to share information and data, but knowledge and skill with all the stakeholders within the value chain of the organisation) (Kruger and Johnson, 2009).

Managing Knowledge in Knowledge-Based Organisation (KBO)

Theory of modern organisation is differentiated by its presumption that "an organisation comprises an integrated system within which all parts are interrelated" (Clancy, 2007). Due to the complexity in the current business setting, there is no ideal way of structuring organisations.

The plan that most suitably manages resources to attain the organisational aims must be reliant on the changing setting. For instance, a rival firm in an external, complicated setting should equal the complicatedness within the firm, in order to still be feasible. A complicated setting means that there are many forms that the whole system can develop into (Clancy, 2007).

Knowledge management plays a key role in a modern organisation. This is because KM can prepare the organisations ahead of any environmental changes whether internal or external to the organisations. Thus, being knowledge-based is a characteristic which can transfer an organisation to a modern organisation. Consequently, organisations should become knowledge-based, if they intend to compete with other competitors in a complex environment (Lim and Klobas, 2000).

A knowledge based organisation comprises an organisation that 1) that performs competently and successfully within its surroundings by building knowledge in a constant way, 2) utilises its knowledge (that which is inherently implanted in the minds of workers, and the explicit entrenched within the work practices and databases, etc.) 3) creates and also implements the accurate organisational culture (distinguished by the liberty to encourage and experiment. 4) supports an flexible structure in organisation (sequential structure integrated with multi-purpose and competent generated project crews) and 5) integrates the communications technologies and the right information so as to encompass the four processes of knowledge change within and outside the organisation (Neagu, 2008).

KM is carried out in numerous diverse methods within organisations. Usually, the KM role is led by a CKO (Chief Knowledge Officer). If the organisation's KM strategy is uncomplicated, the CKO can head a KM Division. In more complex circumstances, with a varied group of KM strategies being applied, the cultural variations that are innate in various strategies imply that a sole division might not be the optimal manner of arranging KM. In these situations, the communications connections between different KM divisions are of considerable significance (King, 2008). Associated with this is the apparent function of organisational culture in impacting the success and practice of KM. A knowledge culture comprises one specific type of organisational culture signifying a "way of organisational existence which... facilitates and encourages people to create, share and employ knowledge to the advantage and maintained success of the organisation." (Oliver and Kandadi, 2006) Organisational culture is thought to impact the knowledge-associated behaviours of people, teams, units and general organisations as it significantly impacts the establishing of which knowledge is suitable to disseminate, when and with whom (King, 2009). However simply applying an additionally knowledge-based business concentration and establishing the required technological infrastructure will not

generate the required changes in culture and conduct to facilitate additionally competent employment of knowledge. There are a number of causes for this: Primarily, organisations which are presently beneficial and riding high within the financial markets will have a challenging time persuading senior management, let alone staff, that a change in the manner in which individuals create, share and employ knowledge is requisite or worth the organisational effort. Therefore, the change to an additionally knowledge-based organisation will possibly be incremental, which means that the current culture will have a great effect on the application of any knowledge strategy. Second, the basic technologies supporting knowledge management will be implemented and formed by the current organisation. This means that the technology will be applied and employed efficiently only to the extent that a culture is lined up to support the aims of knowledge management. This aspect was outlined in a research on Lotus Notes application within a professional services company. Planned to partly enable sharing of knowledge between consultants, the system collapsed due to the inflexible hierarchy of the company and its culture of competitiveness and individualism. Third, numerous companies presently depend greatly on the experience, expertise and quality of their professional and technical staff. In these organisations, human intellectual capital has turned into one of their most important, although intangible, assets. Presuming that these workers are anticipated to important imminently within more knowledge-based organisation, management cannot risk demotivation or alienation of these staff by disregarding their available norms and values when applying a strategy of knowledge management. The comparatively progressive change to additionally knowledge-based organisation, the jointly influential relationship between culture and technology, and the requirement to revere the occupationally described norms and values of a greatly-skilled expert staff all come together to make organisational culture a core element in efficiently enhancing the capability of a company to compete founded on knowledge (De Long, 1997).

Within an organisational or business setting, knowledge organisation literature is inclined towards two key streams: the sort of knowledge produced and stored, and the devices and instruments employed to store it. Most of the knowledge maintained within corporate or organisational knowledge systems is either knowledge required for the process or knowledge of the process (Kasten, 2007).

Kang, Park, and Kim (2003) mention a system of knowledge organisation within which knowledge formed by, and sustaining, the organisational workflow is required and implemented (Kasten, 2007). They additionally classify organisational knowledge as comprising input, output, applied and parallel. Input knowledge is necessary for the current task to be commenced. This could encompass fundamental knowledge of set up (for a production company) or customer requirements (for a service company). This knowledge could be gathered in tasks prior

to the present task. Output knowledge comprises which is formed during the conclusion of the task which could be practical if the task is repeated. This knowledge could comprise knowledge of process enhancement. Applied knowledge is that which is formed during the current task which could be practical in later tasks. Within a process of product creation, for instance, knowledge of a product could be produced within the design stage that could be helpful in the production stage. Lastly, parallel knowledge is that which is formed in a process that could be practical for other tasks not immediately linked to the present task. In the product forming procedure, it is feasible to learn something within the formation of a product that could be seen as practical in the formation of an entirely new product, like experience with particular materials or outcomes from a market appraisal (Kasten, 2007).

Any organisation can be knowledge-based despite the service or product it produces so long as it regards knowledge earnestly. This necessitates to manage its knowledge acquisition and dissemination processes, to design its competitive strategies with consideration for knowledge, and to regard knowledge in any decision making (Zack, 2003).

An organisation which is knowledge-based is comprised of four features that are summarised as place, process, perspective and purpose (Zack and Team, 2012). Place explains that the limits of an organisation, which for the intention of creating and sharing knowledge usually extend past conventional legislative limitations (Kammani et al., 2013). Process states that the activities inside an organisation, several of which are immediately concerned with selling a service or making a product, and others which are ancillary although no less significant (Jayachandran et al., 2004). Perspective mentions that the culture and worldview that impacts and limits the actions and decisions of an organisation (Zack and Team, 2012). Purpose explains that the mission and strategies how can serve profitably of their customers in the organisation.

The organisation can be defined as a knowledge-based organisation if it has capabilities for acquisition, sharing and codifying of knowledge among others (King, 2008). This is an organisation in which one of the purposes or aims comprises the creation of new knowledge. It is likely when the process of knowledge management is established and applied suitably. Sivenco (2008) defines that the life cycle of knowledge management can comprise a visible origin of comprehension of processes within knowledge-based organisation (Figure 2-3).

The first stage comprises the creation or acquisition of knowledge. Following this is the stage of refinement. It comprises the removal of the most appropriate and requisite knowledge for additional employment. Within the storage stage knowledge is included within the organisational memory's history. The subsequent stage comprises the distribution: sharing (among or inside the collective) or transferring (immediately to particular receiver). When

individuals that should be made aware of this new information have learned it, the stage of utilisation follows. It is thought that each of these stages result in developing the organisational performance. Within all stages of the KM cycle, there is no restriction for the articulation of talented individuals. The subsequent stage of refinement concerns the risks taken in addition to the capability to view and select the most suitable ideas amid others. The storage stage permits talents to be created and be rendered tangible; it additionally assists extraordinary individuals to function creatively. For intelligent individuals it is additionally essential to have the chance to interact with other intelligent individuals, to share their outlook and knowledge and believe that they can impact the perspective of other individuals and be part of change-machine inside an organisation. The utilisation section is considerably significant as it is a period within which talented individuals may appraise their ideas and complete their endeavours to provide the outcome that will result in organisational performance, when they will view the outcome of all their innovative activities (Sivenco, 2008).

Knowledge-based organisations concern the product: it explains that one of the products, which the organisation has as an outcome, is knowledge (Sivenco, 2008). As is common globally, in nearly all industries the creation of knowledge is significant for the sustainability of competitive advantage (Shintaku, 2005). When companies are initially in their businesses, they have some immediate assurance of achievement. However when other companies step forward more quickly and form knowledge which could provide them an improved market place, this mentions that the organisation has a superior knowledge management system. Although the knowledge-based organisations concern the substance, the organisational learning process of acquiring this knowledge. Therefore by means of the KM cycle the objective is to form knowledge for implementation, and ultimately, for the enhancement of organisational performance (Carlucci and Schiuma, 2006). It can be carried out through management of processes as stages of KM cycle.
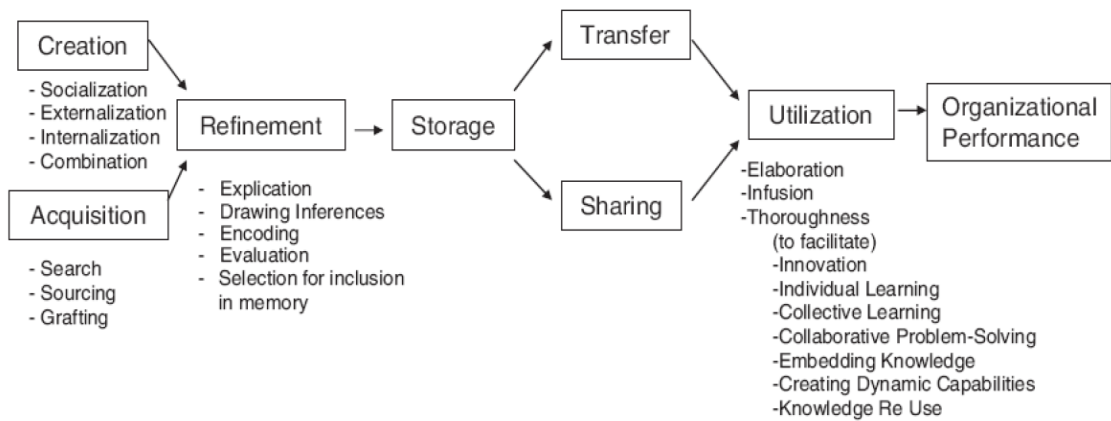
Figure 2-3: KM cycle model (Sivenco, 2008)

The information infrastructure within one organisation which is knowledge-based should comprise ITCs capable of encompassing all four processes of knowledge conversion. The accessible technologies are classified within Table 2-5.

Conversion	Technology
Socialisation	Groupware, Expertise location, Knowledge Map Systems, Visualization tools, Instant Messaging, Email, Knowledge Portals
Externalisation	Groupware, Newsgroups, Forums, Instant messaging, Email, Workflow systems, Artificial Intelligence, Knowledge Portals
Combination	Search Engines, Workflow, Innovation Supporting Tools, Competitive Intelligent tools, BI (Business Intelligence), Document and content management systems, ERP Systems, Intranet, Voice / Speech Recognition, Search Engine, Taxonomy, Knowledge Portals
Internalisation	eLearning, Computer-Based Training, Innovative supporting tools

Table 2-5: ICTs for knowledge-based organisation (Neagu, 2008)

The determination of organisational performance is from the actions' quality applied by staff in the performance of work, which is established by the decisions' quality formed associated with these actions, which is established by the decisions-making' quality which is associated with the standard of knowledge employed in the setting of every resolution, which is associated with the knowledge processes' quality within the company, which is impacted by the quality of knowledge management (Grosbois and Kumar, 2009).

Knowledge which is shared between people helps organisations, in addition to raising the abilities of the people concerned in the process (Sveiby, 2001). Beckmen (1997) particularly

declared that knowledge management comprises one of the significant elements impacting organisational performance and development (Ismail and Yusof, 2008). The essential result from KM is new knowledge, innovation and creativity which will enhance organisational performance (Al-Hawamdeh, 2003). Organisational performance is raised decision-making, measured through time saving, raised customer satisfaction, raised problem solving and quality, and raised competitive advantage in addition to raised organisational learning (Ismail and Yusof, 2008).

The importance of e-business in the organisational activities

e-Business systems are described as any business or managerial dealing or exchange of information made available by an organisation using a network (Lin, 2008), and are often founded on web technologies (Amit and Zott, 2001). Essentially, e-business concerns carrying out business electronically using the internet. This could include activities like collaboration, communication and marketing (Cegarra-Navarro, 2007).

e-Business is more than implementing the presence of internet or carrying out e-commerce dealings, in fact it involves redefining prior business models and maximising significance of business (Lee et al., 2007). e-Business is complicated to employ concerning the changes of business process, and considerable financial investments in sections like networking and computing infrastructure as well as management of human resources (Aldin et al., 2004). e-Business encompasses e-commerce, in addition to front as well as systems of back-office which comprise the modern business engine (Lee et al. 2007).

Basically, e-business comprises a considerably wider concept and is associated with employing the internet and associated technologies to combine and redesign the internal processes, activities and external relations of an organisation, and form new methods of working which are considerably varied from, and usually greatly superior to, what was feasible (or conceivable) previously. Alternatively stated, e-business concerns establishing new methods of working through creative utilisation of the new abilities of ICTs overall and especially internet and associated technologies (Feng, 2007).

e-Business is a new means of managing companies and association with business partners, and reflects a company's strategic objective to employ the internet to disseminate information, enable transactions, and enhance customer service as well as reinforcing integration of back-office (Lin, 2008).

Despite its visibility, pervasiveness and effect, e-business usually remains an inadequately comprehended phenomenon (Gottschalk, 2007). Stated simply, e-business comprises the capability of a company to electronically link, in several ways, numerous organisations, internal as well as external, for a number of varied objectives. It permits an organisation to carry out electronic transactions with any single entity down the value chain of suppliers, distributors, providers of logistics, wholesalers, service providers and ultimate customers (Sharma, 2004). More and more, e-business permits an organisation to institute real-time links concurrently between several entities for some particular objective, like optimising the stream of physical items (completed products, raw materials and components) using the supply chain (Fahey et al., 2001).

e-Business application means that the implementation of communications and internet-based computing to manage the processes of inter-and intra-organisational business. It is swiftly altering the method in which firms sell, buy and deal with their customers, but is additionally becoming an essential element of its business strategy (Abu-Musa, 2004).

Jelassi and Enders (2005) describe e-business as "the employment of electric methods to carry out the business activities both inside and outside the organisation". Internal e-business activities encompass the connection of an organisation's staff with one another by means of an intranet to enhance sharing of information, enable dissemination of knowledge and support reports of the management. e-Business activities additionally encompass supporting activities after sales and cooperating with commercial partners, e.g. carrying out collaborative study, developing a new product and promotion of sales.

e-Business addresses the enabling of transactions and trading of goods and facilities online, i.e. through the internet or any optional telecommunications system. This concerns the e-commerce of digital and physical property, usually including all the stages of trading like online ordering, e-payment, and regarding digital goods, online distribution. e-Commerce applications with external direction are activities of buy-side e-commerce with suppliers as well as activities of sell-side with customers (Jelassi and Enders, 2005). m-Commerce mentions that online activities are similar to those stated in the e-commerce section. The basic technology is varied as mobile commerce is restricted to mobile telecommunication systems, which are available using wireless hand-held instruments like mobile phones, hand-held computers as well as personal digital assistant (PDAs) (Jelassi and Enders, 2005). e-Business encompasses e-commerce and m-commerce (Figure 2-4).
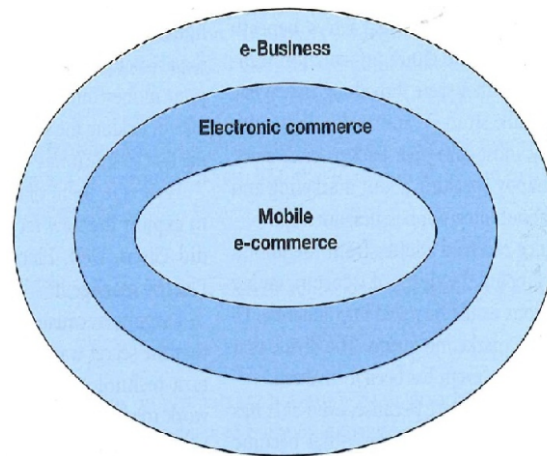
Figure 2-4: e-Business includes e-commerce and m-commerce (Jelassi and Enders, 2005)

Amit and Zott (2001) highlight three aspects of e-business (Cegarra-Navarro et al., 2007):

- Transaction content, which encompasses the availability and employment of intranets and the internet for sharing knowledge

- Transaction structure, which makes reference to individuals and the manner in which they interact and communicate and encompasses cooperative systems and groupware like e-mail

- Transaction governance, which mentions to information and encompasses the systems of collective intelligence, which enable the availability and employment of knowledge to support organisational decisions.

e-Business Stakeholder Model

The e-business stakeholder model concentrates on customers as the stakeholders collaborate to form value for the customers' requirements, and improve results like raised customer satisfaction, and rates of acquisition and retention. The external stakeholders of connections recognised within the model, as highlighted in Figure 2-5, comprise the strategic and operational partners, community, governance and customers. The internal stakeholders are the staff of the firm. These stakeholders have key functions within the value web.
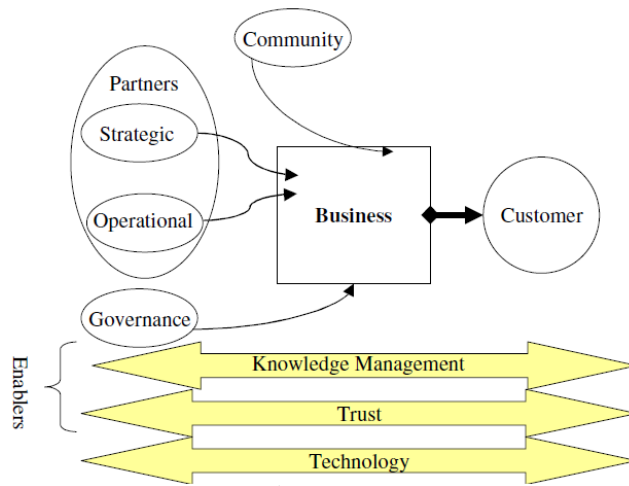
Figure 2-5: e-Business stakeholder model (Jutla, Craig et al. 2001)

The e-business elements for every stakeholder are demonstrated within Table 2-6. In this table, the three key enablers for each of these aspects comprise knowledge management, technology and trust.

Stakeholders	Major Components
Agents	Research and Analysis, Content Management, Sales, Marketing and Service, Community, Education and Entertainment
Community	Engage, Community Interaction, Community Service, Community Governance
Customer	Engage, Order, Fulfilment, Support
Governance	Marketplace Rules, Privacy, Trust, Technological, Economics
Internal Operations	Productivity, e-Culture, Information Systems Infrastructure Services
Operational Partner	Contracts Management, Identification Mechanism, Assurance, Dispute Resolution, Relationship Management, Content Management, Intellectual Asset Management
Strategic Partner	New Alliances, Account Planning, New Market Research, Macro Resource Planning, Product Or Service Development

Table 2-6: Summary of e-business stakeholders and components (Jutla, Craig et al. 2001)

In line with the resource-based perspective of the company, companies acquire competitive advantage by means of "the obtaining, holding and consequent employment of strategic assets" (Dimitriades, 2005). Strategic assets encompass tangible as well as intangible assets (Riahi-Belkaoui, 2003). Tangible assets, like raw material, property, physical technologies and production facilities are currently simple to access, replaceable and replicable (Riahi-Belkaoui, 2003). As a result, the concentration has been slowly moving to intangible assets from tangible assets as strategic assets able to produce sustainable superior performance and competitive

advantage. The basic features of intangible assets as strategic assets comprise their inimitability, rarity and non-replaceable nature in addition to their non-observability (Riahi-Belkaoui, 2003). Intangible assets essential for competitive advantages include brand image, consumer trust, management of distribution and corporate culture, the leadership skills and talent of individuals (Evans et al., 2002), as well as collected learning and experience (Bateman and Snell, 2002). The final feature of the new economy, inter-connectivity, outlines the essential function partnerships resulting in the unrestricted organisation, i.e. complicated arrangements and configurations, usually varying over time (Evans et al., 2002). As well as traditional kinds of partnerships, information and communication technologies have had a role in developing e-business: the applications, information systems as well as internet-enabled integration of processes to enable quick coordination of collaboration and association formation procedure spanning traditional organisational boundaries (Tiwana, 2001). The communities of e-business are comprised of "suppliers, customers, distributors as well as providers of commerce, sharing digital and knowledge systems for competition and collaboration" within the new global-virtual setting (Romano et al., 2001). There are three main problems that are encountered by century business organisations of twenty-first: customer empowerment; changing and the intensification nature of competition; and the consequent improved complexity and dynamism of the setting. The internet and web-based technologies have considerably empowered customers by a way of improved availability of information and interactive communication. However, customer empowerment does not just concern customer self-service, i.e. the accessibility of web-based customer-firm communication (Dimitriades, 2005).

e-Business Network

Strategic networks comprise steady inter-organisational connections that are significant to involved companies. They may embody the form of strategic partnerships, joint ventures, extended-period buyer-supplier partnerships, and other connections (Gulati et al., 2000). Network theorist, traditionally, with a past in organisation theory or sociology have concentrated on the consequences of network structure for creation of value. The network configuration regarding centrality and density (Freeman, 1979) has been regarded as a significant determinant of network benefits, like access, timing and referral advantages (Burt, 1992). Additionally, the network size as well as the heterogeneity of its connections has been considered to have a constructive impact on the accessibility of valuable data to the members inside that network (Granovetter, 1973). The emergence of network of companies within which market and hierarchical authority devices coexist has considerably improved the variety of likely organisational arrangements for creation of value (Gulati, 1998). As a result,

entrepreneurship scholars and strategic management have gone past structural assertions to investigate the significance of governance devices like trust (Lorenzoni and Lipparini, 1999) and the significance of skills and resources, particularly those from customers and suppliers for the formation of value. As well as facilitating availability of information, technologies and markets (Guliati et al., 2000), strategic networks provide the possibility of sharing risk, providing economies of scope and scale, facilitate learning and share knowledge (Dyer and Nobeoka, 2000), and receive the advantages that collect from inter-reliant activities like systems of workflow. Other origins of value within strategic networks encompass reduced period to market, improved competence of transactions, decreased information irregularities and enhanced cooperation between the companies concerned in a partnership (Gulati et al., 2000). The network viewpoint is obviously related for comprehending the creation of wealth in e-business due to the significance of networks of companies, customers, suppliers and partners within the virtual market space (Prahalad and Ramaswamy, 2000). Nonetheless, it may not entirely gather the value creation possibilities of e-business which facilitate transactions in unique and new ways (Amit and Zott, 2001).

e-Business Strategy

e-Business strategy explains how employee, customer, partner, governance and community encountering procedures may be enabled for e-business. e-Business enabling means the manner in which processes of business are enhanced through technological developments, new knowledge management abilities encompassing relationship management and content management, and online trust abilities (Jutla et al. 2001).

Building e-business strategies comprises an IT project. The crucial objective of creating e-business strategy is dealing with the manner in which internet technologies support the organisation and provide competitive advantages by means of the arrangement of its accessible resources to address the requirements of the customers and market, in addition to supporting supply chain management (SCM) the customer relationship management (CRM) (Brynjolfsson,2001).

Creating new e-business strategy for any organisation is regarded as an obligation of senior management (Whittington, 2001) to allocate the necessary resources to execute the project effectively. Resources comprise the subsequent: tangible resources (like Mainframe), intangible resources (like knowledge assets) and human resources (like web designer).

The most important necessary intangible strategy resource comprises knowledge. Additionally, the most strategically significant resource is knowledge in e-business, like specifications of products, trademarks, managements of operations and production, suppliers and customers relationships documentation, organisational culture, reputation and regulations (Carmeli, 2004).

According to Alhawamdeh (2007), creating e-business strategy has four basic phases; initiate, diagnose, breakout and transition.

The first phase is initiate and the aims of this phase include to highlight project scope, recognise stakeholders in the project and establish project program. The second phase is diagnose. The objective of this phase is to establish the strengths, weaknesses, opportunities and threats (SWOT) of the present business strategy, which are carried out through analysing the standing of the organisation between its competitors, and revising the present strategy to comprehend the present associations among the organisation and its customers and suppliers. The third phase is breakout. The aim of this phase comprises to attain a new strategy from the general business strategy to equal the organisational objectives. e-Business strategies could be reliant or autonomous from other organisational strategies. The fourth phase is transition. During this phase, the company must apply the suggested roadmap of the new strategy. This phase shows that the company will shift from present state to the suggested state; this shift is supported by capabilities and new resources.

e-Business in Oil and Gas Industry

Until presently the gas and oil industry gave minor notice to the commercial unrest happening subject to the e-business banner. Ultimately, what pertinence does a transformation in customer management and the channels to the market have on a commodity industry which is asset-intensive? This perception is now altering, as the industry acknowledges that the opportunities and threats are actually as genuine and the consequences as weighty for the consumer industries. e-Business will comprise more simple regulation of instituted investigation and business processes of production. It has the likelihood of basically altering the industry's structure, in addition to the business models implemented by the players of the industry. The present industry players have to resolve the manner in which they are going to remain ahead of the game. They should establish what their e-business objectives should be, and establish strategies to attain these objectives. Speed comprises the essential element of e-strategy, supported by a preparedness to accept basic changes. Numerous firms have become aware of e-business and are including it in several of their key operations. Sections in which e-business has been applied

earliest encompass trading online, supply chain stream-lining (e-procurement), online services and asset licensing.

KPMG Consulting and the Confederation of British Industry highlighted Shell as an instance of best practice within their yearly e-business report, outlining how the firm is employing new technology fulfil crucial business objectives (Hiles, 2010). e-Business manager of Shell (UK) in Exploration and Production, Steve to Rackley, clarified that no e-business revolution strategy has ever existed and they have merely viewed the manner in which e-business may contribute to the main commercial aims like return on investment (Thomas, 2002). This assists in closing the gap separating IT and the rest of the enterprise. The firm's action to merge its international server infrastructure into a general operational setting created the basis of all its e-business efforts. Shell began to provide application services for itself to supply its commercial units with software from four centres globally. They placed considerable investment in the general IT platform. This permitted them to apply some actual pathfinding efforts, especially in purchasing and sharing of knowledge. The application of international knowledge systems, online knowledge as well as suitable practice sharing structures have been observed to comprise one of the most suitable providers of return on investment, producing over £150m in expense savings and raised income. Sharing of knowledge permits them to contrast the cost of products and facilities spanning the group, observing if particular divisions are being overcharged for the same item. Due to the web-based delivery, even the minutest aspects of the enterprise are can log in and acquire the advantages. Shell's employment of e-purchasing, the flagship e-business undertaking in within its investigation and manufacturing section, has gained financial advantages. The smallest instrument can gain a favourable return on investment. E-Surplus is a bulletin board for purchasing employees, which permits staff to control inventory excesses electronically, is a suitable instance. The initial transaction, which was among operating units in Norway and Holland, produced a saving of more than £150,000. This reimbursed the development expenses in itself. Internal projects like e-Surplus, online job openings and Internet-based management have assisted Shell to apply its broader e-business strategy. Comprising a labour force of 90,000, Shell could not simply broadcast a message from management declaring new working rules. The projects assisted to increase the awareness of e-business between workers. The director of tactics for facilitating technologies at KPMG, Andy Tinlin, stated that the core lesson is that it commenced learning rapidly, with no great scheme or open-ended trials (KPMG, 2008). Shell's employment of e-procurement is additionally extended to their suppliers and alternative industry firms by means of public marketplaces like Elemica for the chemical industry and Traderanger for energy. Shell is convinced these marketplaces will be progressively more supported by alternative industry-wide online procedures as companies shift from concentrating on internal competency to wider industry

effectiveness. e-Business manager from Shell UK clarifies that standards will be progressively more significant as firms start to share commercial procedures online.

Tinlin mentioned that a practical technique assists a firm to acquire the most from e-business and firms should view projects that they may apply rapidly (KPMG, 2008). They have to be associated with commercial advantages as opposed to mere return on investment; other in culture and process need to be considered. Looking forward, Shell will progressively more concentrate on online collaboration, inside the group as well as concerning alternative trade participants. New technologies like Web services that enhance communication assist this.

Web services and portal technology have a growingly significant function in the oil and gas industry and the majority of firms acknowledge the significance of integrating web-based portals and systems, in addition to providing visualization which is employed as a swift integration instrument (Wei et al., 2009).

Siemens Model of e-Business Strategy

Siemens is employing the e-business strategy check technology (Figure 2-6), established by SMC (Siemens Management Consulting) for the development of e-business strategy (Damen, 2002). The concept underlying the e-business strategy check is that this technique offers the business unit with an apparent perspective of e-business and a direct means of recognising e-business projects that can support the present strategy. The outcome of the strategy check should comprise a roadmap comprising e-business projects which sustain the business strategy. The outcomes of a strategy check will additionally impact the general strategic theory within the business unit concerning e-business. The various modules and their suggested end-products are illustrated in Table 2-7 (Damen, 2002).
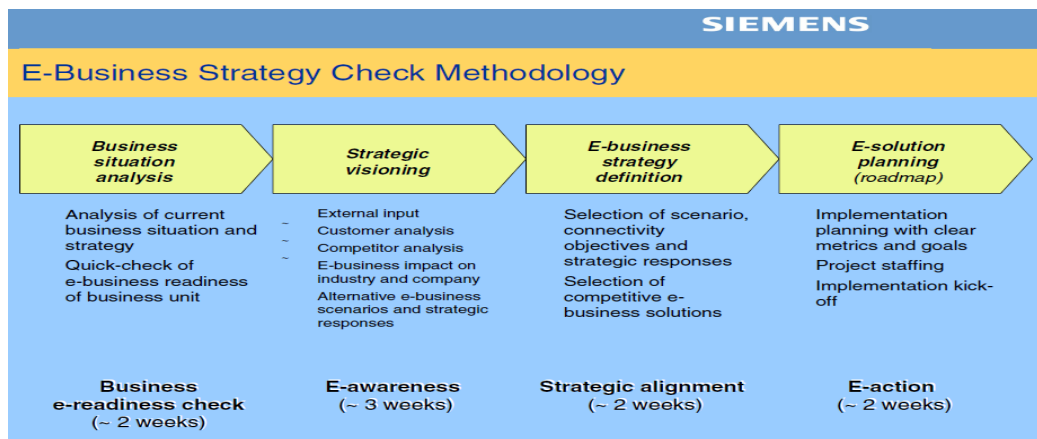
Figure 2-6: e-Business strategy check methodology (Siemens Model) (Damen, 2002)

Module	End-product
Team kick-off	Core team's common understanding and support
Business strategy analysis	Clear picture of current business strategy
Business e-readiness check	Business e-readiness compared to benchmarks(best-of-best / -breed)
E-experience workshop	Managements understanding of e-business impact on their business
E-business strategic discovery	Set of e-business scenarios and strategic responses
Scenario selection workshop	Selected business scenario and strategic responses for the business unit
Solution formulation	Set of described e-business solutions to enforce strategic responses
Decision workshop	Selected e-business solutions for the business
Implementation planning	Implementation plans and teams
Kick-off implementation	Start of implementation of e-business projects
Customer analysis	Deep understanding of customers e-business needs and activities for sound e-solution formulation
Competitor analysis	Understanding of competitors' e-strategies for development of competitive strategic responses and solutions
E-awareness	Management e-know-how and active commitment

Table 2-7: The different modules with their proposed end-products in Siemens model (Damen, 2002)

The outcome of the entire strategy check is summed up within an e-business strategy roadmap of Siemens model (Figure 2-7), which is illustrated in the figure. The projects stated in the various lanes comprise the sole projects that result in the project vision
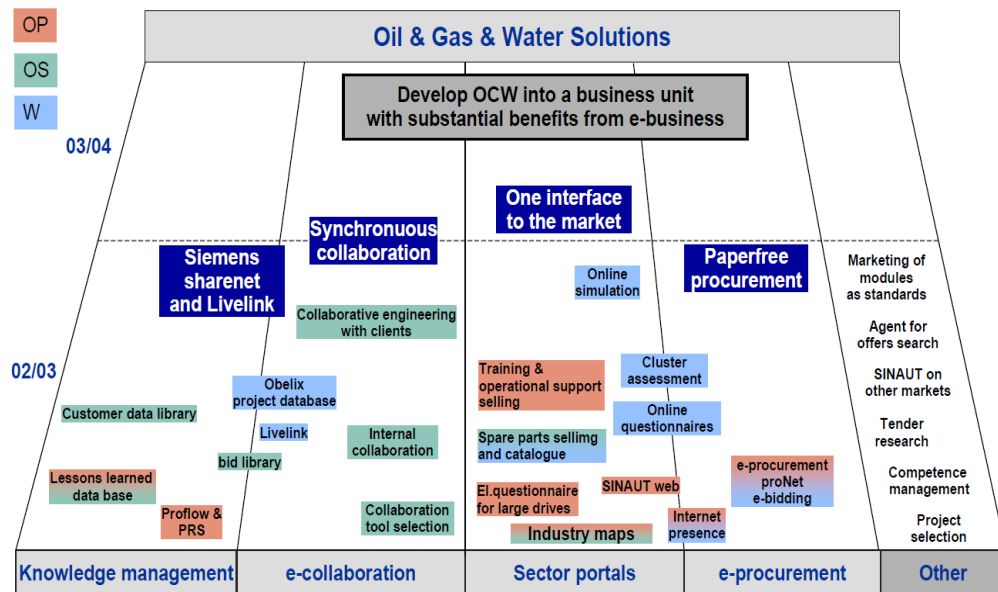
Figure 2-7: e-Business strategy roadmap (Siemens Model) (Damen, 2002)

Interaction of e-Business and Knowledge in the Organisation

Nowadays, technology, trust, knowledge and the associations between stakeholders comprise the keys to achievement in the economy (Julta et al., 2001). Even though for nearly eight decades, strategy literature mentioned that these ideas were significant, it was not capable of efficiently influencing and/or efficiently performing knowledge and relationship management in real time before the turn of the twenty first century. Numerous firms have as yet not altered their working methods to the abilities of current KM and technology enablers. Additionally common is that firms have not yet developed models or methods to form e-business strategy for supporting corporate strategy, or monitoring the e-business strategy's success (Yeh et al., 2006).

Knowledge acquisition is described as the processes of business which employ available knowledge and acquire new knowledge (Lin, 2008). Technical and management innovation necessitate intensive endeavour and experience in acknowledging and acquiring new knowledge (Drucker, 1993). Additionally, Darroch and McNaughton (2002) scrutinized the connection associating KM practices and kinds of innovation, and established that the possibility of efficient company innovation is raised with the level of knowledge acquisition. e-Business infrastructure concerns e-commerce endeavours and is compelled by the gaining of expertise and knowledge (Lin, 2008).

Knowledge dissemination is described as the processes of business which disseminate knowledge between all people involved in activities of process (Lin, 2008). The organisational efficiency of IS explains that a culture of knowledge sharing comprises the key organisational condition for successful KM and utilisation (Damodaran and Olpher, 2000) The study by Caloghirou et al. (2004) states that directness concerning dissemination of knowledge is essential for enhancing performance of innovative. In addition, knowledge dissemination is essential for innovation processes within the setting of e-business (Liebowitz, 2002; Nah et al., 2002).

e-Business-Based Operating Processes in KM

KM provides several perspectives for acquiring, sharing, and utilising know-what, know-how and know-why of these (knowledge) problems. The objective here is not to provide a comprehensive list of KM methods. Instead, it highlights how fundamental methods of KM can facilitate managers and others to ready themselves and the organisation to direct and control the inevitable conversion of operating processes as an introduction to an essential aspect of wining within the marketplace and structuring the organisation necessary to do this (Fahey et al., 2001).

Mentoring: Mentoring embodies the vital function of demonstrating the explicit as well as tacit knowledge of people having a deep comprehension of e-business to people at all the corporate hierarchy levels (Swap et al., 2001).

Self-learning: Organisations emphasise the significance of self-learning as the origin of comprehending vital e-business know-what, know-why and know-how matters (Ho, 2008).

Knowledge repositories: A number of companies establish an electronically available store of related knowledge. These stores provide the substance for the conversations regarding the implications and direction of e-business (Kankanhalli et al., 2005).

Workshops: The objective of these workshops comprises methodically forming and quickly diffusing through a wide group of managers a basic store of knowledge regarding the link between operating processes and e-business (Ajmal et al., 2010).

Pockets of expertise: A major section of a great financial services company instituted a group of people (usually top managers) with the apparent objective of developing the most knowledge possible on the consequences of e-business for all dimensions of the business and to establish devices to distribute and share the knowledge (Ahmed, 2009).

Communities of interest: An additional regular knowledge gambit comprises the formation of a transitory faction of people spanning several silos, usually representing multiple levels of the organisation to share views and ideas concerning e-business, to talk out loud regarding e-business consequences for present or possible organisational and strategy matters, and to direct one another to internal and external e-business resources (Li et al., 2009).

Best practices: Contact with the "best practices" of alternative organisations, usually in unrelated enterprises, has awakened numerous executives to the e-business likelihoods for their own organisations (Zack et al., 2009).

Work assignment. People mostly learn through practice; implementation of knowledge within the "practice" of work offers the origin and support for tacit knowledge (Nam Nguyen and Mohamed, 2011). Therefore, including e-business knowledge advancement within work assignments functions as one of the ultimate means of producing a swift and broad comprehension of the aptitude for e-business to convert operating processes (Nam Nguyen and Mohamed, 2011).

The Role of e-Business and KM in Modern Organisation

In modern organisations, the basic ability to handle information and knowledge is changing for the better every day. To take advantage of these improvements, it is essential to push the development of knowledge systems that will help to redefine the time equation of work (Buckman, 2004). Influencing knowledge is not an objective on its own. Experience has demonstrated that successful strategies of knowledge management are always compelled by apparent connections to business aims (De Long, 1997).

The domain-specific, approach of environmental knowledge organisation is especially appropriate for modern organisations functioning within a knowledge-intensive setting. Knowledge comprises an especially strong instrument in the formation of competitive advantage, and for knowledge to be significant it has to be distinguished and safeguarded from competitions. To distinguish knowledge, it should be special and hard to reproduce. This necessitates that the knowledge formed and implemented by the company has to be organised in line with its particular processes and beliefs (Kasten, 2007).

The modern businesses with ICT-based enforce an essential requirement for business models with elevated extents of adaptability to make room for the adjustments in progress more effectively. In the current business setting, the business model should additionally be enjoying dynamicity so as to deal successfully with the constant changes. Classifying the business model

as dynamic is vital mostly as numerous industries of late, like telecommunications, are experiencing constant changes compelled by innovative technologies, globalisation encompassing deregulations, as well as the changes of market. The business setting has truly been converted. Dissimilar to the traditional business world which is featured by reduced levels of competition and stability, the digital business world is dynamic, complex and has elevated levels of competition and uncertainty (Figure 2-8). Thus, within the additionally complicated and frequently distinctive digital business, the business models have to be clear and additionally flexible (Al-Debei and Avison, 2010).
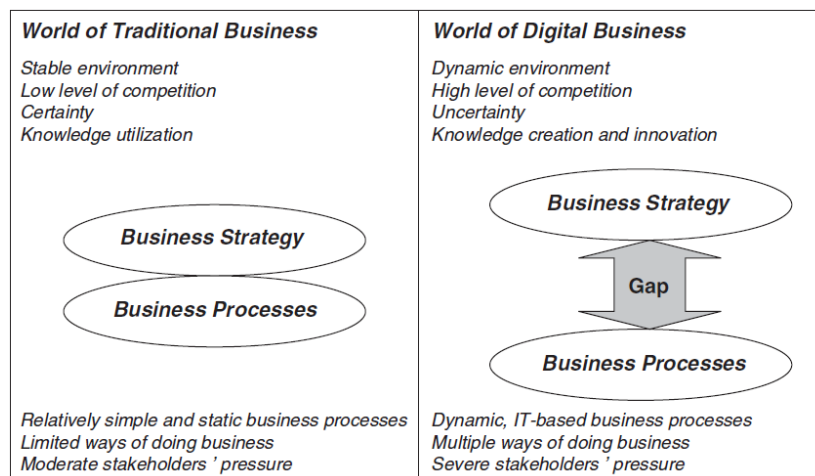
Figure 2-8: Comparison between the world of traditional and modern digital business (Al-Debei and Avison, 2010)

Strategic Capabilities and Their Relationships with e-Business and Knowledge Management

Brotherton (1998) clarifies that knowledge comprises an elementary foundation for the maintenance and development of organisational capability. As competence infers a capability in addition to a purpose to attain described objectives there is an apparent strategic inference within this nexus. Rationally, if the condition of organisational knowledge can be altered then it will have a constructive or unconstructive effect on organisational capability, which will alternatively impact strategic capabilities (Lee, 2001). This sort of difference in organisational knowledge may possibly be produced by KBO in which the organisation's knowledge repository and its process capabilities extend and/or enhance the support for attaining its

strategic objectives (yeo et al., 2010). Thus, the function of KBO is essential in strategic capabilities.

Strategic capability is defined as the group of skills, resources and capacities that construct and long-term competitive advantage for a firm (Jalonen and Lonnqvist, 2011). It comprises the capability to endeavour towards a vision constructed on value adding aspects related to the company and a scheme for revenues that embodies the correct balance among opportunities of short-term and actions of long-term to attain business sustainability. Strategic capability makes reference to an enterprise's capability to effectively utilise business strategy that permit it to endure and raise it worth with time (Osunde, 2014). Although strategic capability considers the strategies employed by an enterprise, it concentrates on the resources, asset and market position, forecasting how well it can imminently utilise strategies (Lengnick-Hall et al., 2011). No ideal technique or universal metric exists to note or measure strategic capability. If firms wish to acquire sustainable competitive benefits, they can apply strategies that use their external opportunities and internal strengths, and prevent their internal weaknesses and external threats (Barney, 2001). Currently, within the age of knowledge economy, innovation has turned into a main supply of competitive advantages (prajogo and Ahmed, 2006). Successful innovation is impacted by numerous contextual and environmental factors (Roberts and Amit, 2003). Organisational learning is another competitive advantage, because it causes enhanced organisational performance. Also, firms are encouraged to become involved in learning activities to improve capabilities of their organisation subject to the setting of technological changes and rising global competition (Selnes and Sallis, 2003).

Porter (1985) described the concept of value chain as an essential instrument for analysing the origins of competitive advantage. Analysis of value chain encompasses disaggregation of the company into its strategically related activities to comprehend the conduct of expenses and the available and possible origins of separation (Bhatnagar and Teo, 2009). A company acquires competitive advantage by carrying out these strategically significant activities more economically or in a manner superior to its competition.

Absorptive capacity is also a competitive advantage (Daghfous, 2004). Absorptive capacity is described as the capability to facilitate companies' efficiently obtaining and employing external and internal knowledge, which influences performance (Fichman, 2004). Firms cannot simply depend on the external networking, but additionally must establish their absorptive capabilities to acquire knowledge actively (Matthyssens et al., 2005).

Absorptive capacity has a minimum of two significant aspects: resiliency and agility (McCann et al., 2009). The current awareness of agility is the result of a conviction that the best-

functioning organisations within rapid-paced settings move rapidly to recognise chances and avert crashes (McCann, 2004). Agility comprises the ability to swiftly react to changes in customer and market requirements as the holder of competitive advantage. Regardless of the apparent advantages of agility, organisations encounter difficulties in applying the required measures to raise their agility (Ismail and Sharifi, 2006). Agility explains employing market knowledge and a virtual company to utilise fruitful opportunities in an unstable marketplace (mason-Jones et al., 2000). Several of the abilities related to agility have an extended pedigree in psychological as well as change-management research. Practices of the change-management intended to enhance agility have focused on forming openness to adjustment and ascertaining fast implementation of strategy through eliminating cultural and structural limitations that restrict the stream of work, idea, people and resources (Swafford et al., 2006). This could explain swiftly quitting reducing markets, employing joint ventures, outsourcing considerably and forming international supply chains. It additionally mentions being good at rationalizing appearing circumstances and redeploying reserves to swiftly combat or profit from them (Heifetz et al., 2009).

Resiliency comprises a new concept which has been researched in organisational leadership (Harland et al., 2005). Thus, making resilient leaders constitutes the best method to make sure that your organisation will flourish in a greatly unstable and chaotic future, and those resilient organisations constantly survive their weaker competitors (Stoltz, 2004). Resilience has considerable possibilities of providing management insights into their weaknesses, strengths and priorities (Boin and McConnell, 2007). Nonetheless, resilience is not just an issue of strengths, but constitutes the balance among organisational capabilities and weaknesses that make up a company's actual competitive advantage (Pettit, 2008).

The mentioned strategic capabilities and their relationship with e-business and KM have been explained in this part.

Innovation

Scholars have stated different definitions of innovations in an endeavour to clarify what is comprehended by innovativeness. Some significant definitions of innovations are listed in Table 2-8. Schumpeter (1934) initially discovered the essential function of innovation within economic development of countries. He argued that innovation is comparable to one of these patterns, the initiation of new goods as well as a new technique of manufacturing, the opening

of a new market, the acquisition of a new provision of raw materials or half-manufactured products or performance of the new organisation from any industry (Alegre and Chiva, 2008).

Organisational innovation is rapidly turning into an essential aspect in company endurance due to the advancement of the competitive setting. In this strain, Balachandra and Friar (1997) contemplated that the successful initiation of new products comprises the lifeblood of the majority of organisations.

Drejer (2003) recognised five activities, which jointly describe innovation management: process of new product development, technological integration, strategic technology planning, business development, and organisational change. Alternatively, Cooper and Kleinschmidt (1995) recognised and defined five categories of key aspects of success in innovation management: strategy, process, commitment, culture and organisation (Biloslavo, 2005).

Definition	Author
Product innovation consists of successful exploitation of new ideas	Myers and Marquis, 1969
Company innovation is defined as the taking up of an idea or behaviour in relation to a product, service, instrument, system, policy or program that is new to the company.	Zaltman et al., 1973; Damanpour and Evan, 1984; Daft, 1992
Innovativeness is "the capacity and tendency to purchase new products and services"	Foxall, 1984
Innovation is the actual use of a nontrivial change and improvement in a process, product, or system that is novel to the institution developing the change.	Slaughter, 1998
Organizational innovativeness is an organization's overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behaviour and process.	Wang and Ahmed, 2004

Table 2-8: Some definitions of innovation (Tohidi and Mandegari, 2012)

Innovation is broadly viewed as a vital resource of competitive advantage in a progressively changing setting (Des and Picken, 2000). Management scholars state that innovation capability comprises the most significant decider of organisation performance (Mone et al., 1998). The innovation is defined that comprises: adoption or production, transformation and utilisation of a value-added newness in social and economic domains; expansion and renewal of services, products as well as markets; establishment of new manufacturing techniques; and development of new management systems. It comprises a process as well as an outcome (Crossan and Apaydin, 2010). The Product Development and Management Association defined innovation as a "new idea, instrument or method. The act of forming a new process or product. The act

encompasses invention in addition to the work necessary to bring a concept or idea into ultimate form" (Belliveau et al., 2002).

Not much empirical study has particularly dealt with antecedents and implications of effective KM (Darroch and McNaughton, 2002). The management of knowledge is frequently acknowledged as a significant antecedent of innovation. The effective KM is a method of enhancing performance and innovation. Although numerous researches have documented KM as an antecedent of innovation, none has overtly scrutinized the association linking the two constructs. From Darroch (2005) acquired that the outcome of KM process would constructively impact innovation. Thus, it is fair to assume that the association linking KM and innovation is very close. Therefore, knowledge management impacts organisational innovation constructively (Liao and Wu, 2010).

The theory of innovation diffusion provides a group of innovation features that could impact decision-making in the organisation (Rogers, 1995). These innovation features encompass complexity, compatibility, observability, trialability and relative advantage (Rogers, 1995). Between these features, complexity, compatibility and relative advantage were established to comprise the most frequently recognised elements for IT-based diffusion of innovation (Verhoef and Langerak, 2001).

The relative advantage is the degree to which an innovation provides more advantages than its precursor. The relative advantage is observed as raised effectiveness, efficiency, enhanced status and economic advantages (Rogers, 1995). Moore and Benbasat (1991) explained that alleged relative advantage of an innovation is constructively associated with the level of implementation. Respectively, the possibility of e-business disclosed apparent advantages like making internal process additionally effective, enhancing customer services, and improving collaboration with suppliers (Zhu and Kraemer, 2002). Overall, when decision-makers understand apparent general organisational advantages of e-business, they are additionally likely to attain successful e-business application and to attain additional e-business value (Lin, 2008).

Knowledge management is appearing as a significant idea and is regularly mentioned as an antecedent of innovation (Darroch and McNaughton, 2002). Increasingly more firms are maintaining and lunching knowledge management efforts to profit from the dynamic endeavours of interactive process. In addition, recent studies emphasised that within a setting of swift technological innovation, companies regard organisational capabilities by means of the knowledge collection, integration and distribution (Grant, 1996). Effective processes of knowledge management, like acquisition of knowledge, sharing and utilisation are essential for selecting new technology (Lin and Lee, 2005).

Organisational Learning

The significance of the elements that enable organisational learning has traditionally been associated with the learning organisation literature, which mostly concentrates on the establishment of normative models for the formation of a learning organisation (Rebelo and Gomes, 2011). The increasing mass of organisational learning research initiates a viewpoint that learning is not just the ability of people; learning may additionally take place at a group level and is enabled by an organisational climate which facilitates the motivation and condition for learning (Nemeth, 1997). By learning, organisations may adjust to the circumstantial limitations, avert the reproduction of previous errors and conserve essential knowledge that could alternatively be lost (Dixon and Meyer, 2007).

In an endeavour to react to internal and external calls for development and success, numerous organisations have implemented the objective of being a learning organisation (Pourhamidi, 2013). Organisational learning is a constant process of organisational development and enhancement that is integrated with work activities; raises the alignment of values, opinions and views amid institutional participants; and employs information or feedback concerning the outcomes and processes to implement changes. Appraisal carried out in support of organisational learning that provides a method for development of inquirers' communities, capturing the intellectual capital of its members, and dealing with challenges or opportunities encountered by the organisation (Gilley and Gilley, 2009). Applying evaluation efforts and organisational learning and, nonetheless, does not comprise a simple task. It necessitates that the organisation carefully appraises the manner in which to organise its structures, regulations, processes and members are to support evaluation practices and organisational learning (Preskill and Torres, 1999).

The recent studies have explained that the capacity of organisational learning as a main factor in impacting deployment of IS (Zahay and Handfield, 2004). In spite of the commonness of IT within modern organisation, evidence is increasing regarding the inability to optimise organisational efficiency due to poor staff reception of new technology (Johnson, 2001). Accessibility of training and strong technical capability have been highlighted as requisite in a company employing IT to enhance key skills (Ravichandran and Lertwongsatien, 2005). Accessibility of training refers to amount of learning accessible to users or adopters. Prior studies have demonstrated that training and education comprise essential elements for implementation of technology (Florin and Bradford, 2003). Employing e-business requires investment in staff training and IT infrastructure. Supply of adequate training assists firms to acquire the necessary IT human resources and progress them into superior e-business

functionalities to attain the possible e-business worth (Zhu and Kraemer, 2005). Thus, companies that commit considerable training resources towards IT are additionally inclined to apply e-business and attain its value effectively.

Organisational learning is the processes or capacity inside the company facilitating the acquiring of, revision of and access to organisational memory, thus providing directions for organisational activity (Robey et al., 2002). Combining previous endeavours from the concept of knowledge management, organisational learning, and technology application and adoption (Lee and Kim, 2007), four elements that reflects the construct of capabilities of organisational learning within a technology diffusing setting are: knowledge acquisition, knowledge dissemination, system orientation and managerial commitment. Management should acknowledge the applicability of learning, thereby establishing a culture promotes the creation, acquisition and transformation of knowledge as basic origins of innovation (Nonaka and Takeuchi, 1995). Management should ascertain that the company's staff comprehend the significance of learning, and take part in its achievement, regarding it as an active aspect of the diffusion of complicated technological creations (Williams, 2001). IS application study has additionally asserted that successful initiation of new or varied systems is less feasible with no managerial backing.

The concentration on knowledge construction is parallel to current contributions to the organisational learning study stream (Huysman, 2000). Viewing knowledge management and organisational learning as a process of rebuilding organisational knowledge infers a social constructivist perspective to knowledge (Gergen, 1994). The social constructivist perspective states that organisational learning is viewed as an institutionalising process by which personal knowledge is converted to organisational knowledge. Institutionalisation comprises the process by which practice is made adequately habitual and consistent to be defined as institutional. The concentration is on the process by which personal or restricted knowledge is converted to mutual knowledge in addition to the procedure by which this socially built knowledge impacts and constitutes restricted knowledge (Nonaka, 1995). Regarding collective or organisational knowledge, allusion is made to knowledge as in regulations, processes, activities, strategies, technologies, circumstances, paradigms, or frames of references around which organisations are built and by which they function (Levitt and March, 1988). It is essential that organisational knowledge is able to endure substantial turnover in singular actors (Pentland, 1995). Berger and Luckmann (1966) define three stages that can be distinguished within the institutionalization of knowledge: objectifying, internalising and externalising. Externalising knowledge is the process by which knowledge is swapped with others. Objectifying knowledge is the process by which knowledge is rendered an objective actuality. Within internalising of knowledge, the objectified knowledge is employed by people during their socialisation. In association with organisational

learning processes, sharing of knowledge may be evaluated as comprising these three knowledge-sharing processes: externalising personal knowledge to the level that knowledge is communicated; objectifying this knowledge into organisational knowledge to the level that knowledge is undervalued; and internalising this organisational knowledge by people from the organisation. On top of these three processes which in total ascertain the institutionalization of organisational knowledge, knowledge management concentrates on the formation of new knowledge, or knowledge development.

Value Chain

Porter (1985) describes value as "the quantity buyers are prepared to pay for what is given to them by a company". Value chain evaluation recognises the activities of the company and then scrutinizes the economic consequences of those activities (Kar, 2009). Value chain evaluation investigates the primary activities which have an immediate effect on creating value and supporting activities, which impact value merely by means of their effect on the primary o activities and the performance (Gwoki, 2014). Primary activities concern the formation of physical items and encompass operations, inbound logistics, outbound logistics, sales and marketing, and service (Pietrobelli and Saliola, 2008). Porter and Millar (1985) assert that information technology (IT) creates value through supporting variation strategies. Value chain analysis is practical in investigating value creation in virtual markets. For instance, Amazon.com resolved to construct its own warehouses to raise the swiftness and dependability of the delivery of items procured online. In so doing, it was capable of increasing value to sales and satisfaction activities. Stabell and Fjelstad (1998) saw the value chain model as appropriate for the evaluations of production and manufacturing companies as opposed to service companies in which the consequent chain does not completely gather the essence of the value creation devices of the company.

Rayport and Sviokla (1995) suggest a virtual value chain which encompasses a pattern of acquiring, organising, sharing and utilising information and knowledge. Although this change of the value chain concept relates better with the actualities of virtual markets, especially the significance of knowledge (Shapiro and Varian, 1999), there could still be an opportunity to gain the richness of e-business activities more entirely. Opportunities of value creation in virtual markets could be the outcome of new mixture of knowledge, innovative configuration of transaction, and physical services and products, the integration and reconfiguration of capabilities, role, relationships and resources between partners, customers and suppliers, (Amit and Zott, 2001).

Absorptive Capacity

Tu et al. (2006) described absorptive capacity as the mechanism that assist to recognise, communicate as well as assimilate applicable external and internal knowledge in the organisation. The aspects of absorptive capability are regarded as the company's available knowledge foundation, the system's effectiveness that appraise the setting, and the effectiveness of the company's communication processes. Also, absorptive capacity is described as a group of organisational activities which companies use to acquire, assimilate, share and exploit knowledge to provide a dynamic organisational capacity (Chen et al., 2009). Knowledge acquisition is the capability to identify, value, and obtain external knowledge which is essential for the performance of a company (Zara and George, 2002). Knowledge assimilation signifies a company's processes and activities which permit it to comprehend, evaluate and translate external knowledge. Knowledge sharing is the company's capability to establish activities which enable integration of available knowledge with currently acquired and assimilated knowledge (Zahra and George, 2002). Knowledge exploitation is a company's capability to implement new external knowledge commercially to attain company aims (Lane and Lubatkin, 1998).

Gathered associated previous knowledge may raise the absorptive capacity of the organisation, thereby raising the capability to be agile. The stored knowledge quality in the organisation has an essential function knowledge application and adoption. Knowledge bases have to be constantly updated and cleaned, and the consistency and integrity of knowledge must be maintained (Lesjak et al., 2003). High quality knowledge raise the value of constructing absorptive capabilities to gain opportunities, establish strategies, and apply them efficiency and effectively. Thus, knowledge quality acquired by information technologies within the organisation can impact absorptive capacity of the organisation (Ashrafi et al., 2006).

Absorptive capacity has been demonstrated to comprise an essential aspect in comprehending IT management practice and IT employment in addition to improving the capability to efficiently apply new IT (Harrington and Guimaraes, 2005). The absorptive capacity is the group of organisational processes and routines concerned in acquisition, application and sharing knowledge to generate dynamic capabilities in the organisation. Effective KM processes, like acquiring, applying and sharing knowledge are essential for the success of IT application. Knowledge acquisition is described as the processes of business that employ available knowledge and gain new knowledge. Advancement of e-business necessitates intense endeavour and experience in acknowledging and gathering new knowledge (Etemad, 2004). Organisations often must obtain the know-what, know-why and know-how to assimilate any complicated

technology effectively (Attewell, 1992). Know-what comprises accurate knowledge regarding technological innovation and its characteristics, know-how comprises knowledge regarding application of a technological innovation in an organisation, and know-why is knowledge necessary to significantly measure the cost benefits and hazards of implementing a technological innovation (Ravichandran and Lertwongsatien, 2005). Additionally, Moodley (2003) highlighted that e-business infrastructure concerns e-commerce endeavours and is additionally compelled by acquisition skills and knowledge. Associations among knowledge acquisition skills are therefore anticipated to be constructively associated with e-business application success. Knowledge application is described as the processes of business by which effective storage and extraction devices allow a company to gain knowledge simply. From the viewpoints of technological innovation, transfer of knowledge, integration and practical application of knowledge comprise the main factors for advancing technological capabilities (Johanessen et al., 1999). Companies that improve and develop organisational application of knowledge may most likely attain productive application of e-business.

Knowledge sharing constitutes an efficient means of enabling internal communication and raising the decision-making ability of an organisation (Cohen and Levinthal, 1990). It is essential to disseminate knowledge over the organisation so that knowledge can be distributed of by individuals that require it. Therefore, one significant function of IT within KM is to efficiently disseminate applicable knowledge. Samaburthy et al. (2003) researched the digitalised knowledge reach within agile business. Digitalised knowledge reach is described as availability and comprehensiveness of codified knowledge within a company's knowledge base and the interrelated systems and networks for improving communications between people for the sharing and dissemination of knowledge." The description illustrates the significance of knowledge dissemination. They asserted that digitalised knowledge reach has an immediate effect on business agility. Therefore, knowledge sharing can enhance IT abilities of controlling knowledge, which consequently has an immediate effect on the absorptive capacity that impacts business agility (Ashrafi et al., 2006).

Agility

In a general sense, agility comprises the capability of the company, and subsequently its supply chain, to adapt and respond to a business setting featured by constant and dynamic change (Yusuf et al., 2014). Agility is described as "the capability of an (inter-connected) organisation to discover changes, opportunities and threats within its business setting and to provide rapid and concentrated answers to customers, in addition to other stakeholders, through rearranging

processes and resources, and by strategic alliances and partnerships" (Pavlou ad El Sawy, 2004). Even though academia and industry concur on the basic significance of attaining agility, there is contention regarding what it requires to be agile in this new unstable and often uncontrollable setting (Mathiyalakan et al., 2005). Also agility is the capability of the company to redesign its available processes speedily, and form new processes in a timely manner to make the most advantages of dynamic market circumstances (Zaini and Masrek,2013).

Two concepts, dynamic capability and absorptive capacity, have an essential function in applying agility (Ashrafi et al., 2006). A company's dynamic capability has drawn the notice of the IS community in the setting of IT-enabled strategic agility and flexibility (Pavlou and El Sawy, 2004). The idea of was initially launched by Teece (1997) and was described as the company's ability "to build, reconfigure and integrate internal and external competences to deal with speedily environmental changes." Eisenhardt and Martin (2000) have mentioned an additionally definition of dynamic capabilities; The company processes that employ resources, particularly the processes to reconfigure, integrate, attain and release resources to equal and even cause market change. Dynamic capabilities therefore comprise the strategic and organisational routines by which companies attain new resource structures as markets split, collide, emerge, evolve and die. This description obviously indicates the constructive effect of dynamic capabilities on agility (Jiao et al., 2013). Absorptive capacity is described as the capability to acknowledge the worth of new external knowledge, assimilate it, and implement it for business objectives (Cohen and Levinthal, 1990). Cohen and Levinthal (1990) initiated the idea of absorptive capacity as the company's capability to recognise, assimilate and utilise new knowledge from the surroundings. To comprehend and value new knowledge, the company should hold previously associated knowledge fundamental to the new knowledge in that previous fundamental knowledge has to be related and encourage the comprehension of the conventions and methods on which a discipline is founded, encompassing: problem solving techniques and skills, previously acquired knowledge and abilities, and a common language (Cohen andLevinthal, 1990).

Zahra and George (2002) point out four aspects of absorptive capacity; 1) acquisition comprises the capability to recognise and obtain knowledge, 2) assimilation comprises the capability to take in, translate and combine knowledge, 3) transformation comprises the capability to integrate and extend available resources inside the assimilated knowledge, and 4) exploitation comprises the capability to influence knowledge into new applications. These elements associate absorptive capacity to the proficiencies of utilizing knowledge to attain preferred results. Absorptive capacity impacts innovative performance by assisting to forecast more

precisely the character and business possibilities of technological developments (Schleimer and Riege, 2009).

To be agile within the current internationally linked and technologically networked market arena, a company has to be capable of discerning changes in its commercial setting and take actions to reorganise the unconstructive effects or make the most of the opportunities. This implies that sharing of information and knowledge management inside the organisation as well as spanning external entities are conditioned for attaining agility. An agile business employs knowledge regarding its internal and external setting to change its processes, routines and resource structures (Cao and Dowalatshahi, 2005). Internal knowledge of the company mentions to process and product, capabilities and specifications, inter-operability, organisational culture, leadership and staff skill sets. The external knowledge makes reference to the knowledge of competitors, markets, technological trends, altering customer wishes, etc. It additionally mentions that the knowledge available from other actors in the marketplace if the company, using acquisitions, mergers partnerships, alliances and alternative cooperation techniques gains the knowledge for individual employment (Ashrafi et al., 2006).

To acquire agility, knowledge management devices is required which assist in predicting altering market dynamics, adapt to these dynamics, and speed up enterprise change rapider than the rate of change within the market place. Different IT devices are accessible to assist in enhancing knowledge quality and efficiently obtain, disseminate, implement and improve knowledge (Liebowitz and Megbolugbe, 2003).

Knowledge diversity is supported through constructing a society of practice. Wenger et al. (2002) have established several aspects as the main aspects for constructing a society of practice. These aspects are immediately or indirectly associated with agility. For instance, they note that the dynamic character of communities is essential for their development; as the community develops new members bring new ideas and interest thus draw the concentration of the community in various directions. Suitable community configuration draws numerous varied levels of involvement from suppliers, customers and competitors (Hong, 2002). Knowledge reuse concentrates on employing old knowledge to address new challenges. A knowledge repository comprising available (internal and external) knowledge comprises the most favourable outcome of computing. It is additionally one of the more challenging computing problems. For instance, the external knowledge for an inventor requires filtering through patent search to discover information related to a new discovery or inquiry path (Ashrafi et al., 2006).

Resilience

Organisational resilience is described here as a company's capability to efficiently absorb, develop situation-particular reactions to, and eventually become involved in transformative activities to capitalise on disturbing surprises that possibly threaten survival of the organisation (Lengnick-Hall et al., 2010). Additionally, it is the capability to survive a crisis and prosper in a world of uncertainty (Whitman, 2014). Another definition of resilience is a basic characteristic of people, groups, systems and organisations in their entirety to react productively to important change which disturbs the anticipated sequence of events without becoming in involved in a lengthened period of regressive conduct (Riolli and Savicki, 2003). Contextual circumstances that enable resilience depend on associations inside and outside an organisation to enable efficient reactions to environmental complications. Four basic contextual circumstances encompass: psychological security, deep social capital, disperse authority and responsibility, and wide resource networks (Lengnick-Hall and beck, 2003, and Lengnick-hall and Beck, 2005). Together, these aspects encourage interpersonal links and resource supply lines that result in the capability to function rapidly under appearing circumstances that are unstable and unexpected.

Organisational Performance

As knowledge is fast turning into a considerably significant measure of the organisational future performance, it is thus essential that signals and measurement methods are established so as to permit managers to deal with the organisational knowledge better (Choi and Lee, 2002). The role that can be embodied by KM is a significant matter for study, particularly provided the rising emphasis on the idea of knowledge workers as well as the KBO. Additionally, KM has the possibility of assisting organisations to capture, organise, select, disseminate and transfer considerable information, knowledge and skill which facilitates enhancement of organisational performance (Tubigi and Alshawi, 2012). Considerable research has outlined the significance of knowledge in organisational performance, and organisations are additionally interested in management of their knowledge efficiently to stay ahead of their competitors. Organisational performance is constituted of the real production or outcomes of an organisation as measured against its aimed results (Objectives and goals) (Liapreecha and Chamnanchang, 2013). Profits, cost, satisfaction and time of operation are the most significant criteria to measure organisational performance non-financially and financially. (Broadbent and Laughlin, 2009).

Lee and Choi (2003) summarised that so long as KM practices improve elements of organisational performance, constructive financial performance will subsequently result. They established immediate association among KM practices and different intermediate measures of strategic organisational performance, particularly; operational express, customer intimacy and product leadership, which alternatively are related to financial performance. Therefore, as a vital factor, organisational performance should be evaluated when the organisation transfers to knowledge based organisation.

Summary of the Literature Review

Knowledge lies on a continuum between tacit and explicit knowledge and KM is a formalized and active approach to managing and optimizing knowledge resources in an organisation. KM and technology play a key role in modern organisations. However, the process of managing knowledge cannot be simply managed by technologically enabled solutions and practices. Communication of practices and knowledge networks is a vital factor to adapt organisations to the environmental changes and to compete successfully. Advances in IT and ICT which are leading to new domains of e-business are becoming critical in managing knowledge and knowledge networks to help organisations. Consequently it is learnt that KM and e-business systems are becoming complementary features of modern organisations, and as such have been applied in the oil and gas industry. Different KM and e-business models and their relationships have been studied in the literature, however the aspects of communication and networking of such systems and their interrelationships are not addressed properly yet. There is a gap here particularly regarding their application in the critical industry of oil and gas. As a result, how to interrelate and integrate of KM and e-business is fundamental when organisation transfer to knowledge based organisation, because this integration and interaction will have effects on strategic capabilities and organisational performance.

CHAPTER 3: CONCEPTUAL FRAMEWORK AND RESEARCH MODEL

Introduction

A conceptual framework clarifies the main areas to be scrutinised, the main elements or variables, and the supposed relationship connecting them in either narrative state or graphically. Suggestions are made by Miles and Huberman (1994) regarding the development of a conceptual framework, and assert that the most suitable means of carrying this out is by graph, as opposed to writing. Additionally, one must anticipate performing a number of iterations within the framework.

The main objective of this chapter is to design a research model which derived from KM and e-business strategies and models as found in the literature, choosing specific, concepts for utilisation by this study. The limitations of the previous research have identified the gap in the literature and accordingly the conceptual framework in which this study seeks to present. Therefore, according to the literature, the conceptual framework of this research comprises four main parts:

- The first part explains how an organisation with the process and content of KM strategies can be changed to a knowledge-based organisation

- The second part demonstrates how an organisation with the use of the web-technology can formulate an appropriate e-business strategy.

- The third part designs the model of the research in accordance with KM and e-business strategies and the designed KBO model.

- Finally, the core questions and propositions of the research design are based on the designed research model and the literature review.

KBO Model of the Research

As mentioned in the literature review, the KM cycle model explains that an organisation can be defined as an organisation which is knowledge-based if it includes capabilities for acquisition, sharing and codifying of knowledge among others (Sivenco, 2008). This comprises an

organisation in which one of the aims or goals comprises the formation of new knowledge (Saviotti, 2009). KBO is created when the process of KM is developed and applied in a satisfactory manner (Sivenco, 2008).

Figure 3-1 is a KBO model which is derived from nine KM and KBO models (appendix 1) (Alavi and Leidner, 1999; Fahey et al,. 2001; Alavi and Leidner, 2001; Lytras and Pouloudi, 2003; Carrillo, 2004; Jennex, 2007; Neagu, 2008; Ismail and Yusof, 2008; King, 2009).

Knowledge-based organisation (KBO) is defined in this research as an ICT (and web)-enabled organisation which uses knowledge acquisition, distribution and utilisation to lead to innovation, learning, communication and efficiency in the organisation. As mentioned in the literature review, an organisation can acquire, distribute and utilise knowledge through web-based systems (Sivenco, 2008), but if this knowledge cannot lead to innovation (Darroch, 2005), organisational learning (Kanchana et al., 2011), absorptive capacity (Liao et al., 2007), value chain (Danskin et al., 2005), agility (Sherand Lee, 2004) and resilience (Alavi et al., 2006), this organisation is not a knowledge-based organisation.
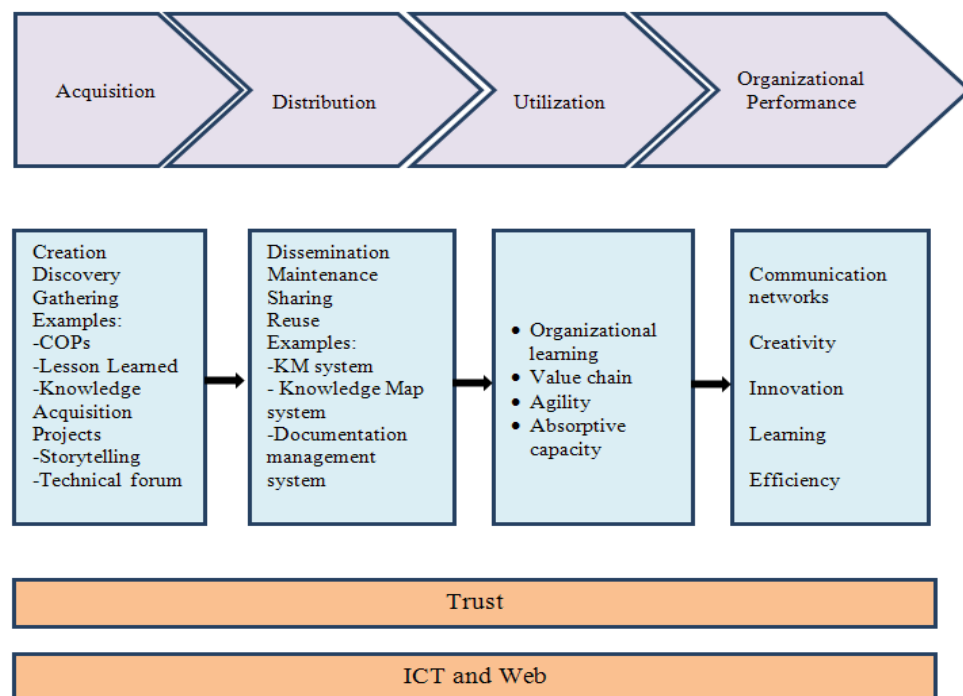
Figure 3-1: KBO Model (Components and Process)

As figure 3-1 demonstrates, the first phase of KBO model comprises the acquisition of knowledge, which carries out by internal or external processes of knowledge creation. The subsequent phase comprises the distribution: transmission (immediately to special receiver) or

sharing (among or inside the gathering). After the individuals required to have this new knowledge has been learned, the utilisation (the next phase) is required (Sivenco, 2008).

Two most important characteristics of a knowledge-based organisation are innovation and learning (Kasten, 2007; Neagu, 2008). Also, Sivenco (2008) clarifies that innovation and learning are two critical factors in the phase of utilisation in the KM cycle model. On the other hand, KM strategy has a two-way communication with knowledge management and business strategy (De long, 1997; Zack, 1999; Beckett et al., 2000; Denford and Chan, 2011). Consequently, KBO, KM, KM strategy and business strategy have a mutual relationship with each other.

Success of an organisation in achieving its objectives (KM, business model, e-business) is reliant on numerous elements. One of the more significant contributors comprises trust. Trust is an issue which an organisation has to endeavour to attain with time. Trust can be perceived from numerous angles like product, information content, organisation and technology, and deal (Velmurugan, 2009). For instance gaining customer trust is reliant on numerous aspects that are managed by e-business systems. Nonetheless, the trust of a customer as such is not subject to the management of the e-business. Some elements that result in the attaining of customer trust comprise: attraction of the website, service and product offers, the standard of service and trusted seals, as well as branding (Srinivasan, 2004).

e-Business Strategy Process

The subsequent part of the conceptual framework describes an e-business model. In fact, this model is an integration of the e-Business Stakeholder Model (Jutla, Craig et al. 2001), Siemens Model (e-Business Strategy Check Methodology) (Damen, 2002) and the stages of building an e-business strategy (Alhawamdeh, 2007). Therefore, different stages of this e-business strategy model (Figure 3-2) are explained briefly.

Business environment (BE) assessment is a stage in which customer and competitor should be analysed to determine the impact of environment on industry and company (Damen, 2002). The industry of a company is described as a gathering of companies manufacturing a similar main product (Johnson and Scholes, 2002). A means commonly referred to which is used to analyse an industry comprises the five forces analysis of Porter (Porter, 2001). The five forces are categorised as competition amid existing rivals, threat of new entrants, threat of new replacement services or products, bargaining power of suppliers and bargaining power of customers (Porter, 2001). Johnson and Scholes (2002) propose that the five forces analysis theory from Porter should be employed at the level of SBU (strategic business unit). Whilst

analysing of the bargaining power of suppliers and customers, one may observe the intensity of suppliers and customers, the accessibility of optional origins of supply for customers, and the threats of forward and backward combination. Competitive rivalry is impacted by the amount of rivals, the level to which rivals are balancing, and exit obstacles (Damen, 2002).

Another stage is technology assessment. This stage deals with relevant technologies, IS strategies and which strategies, business models and infrastructure a company should choose (Alhawamdeh, 2007). The aspect of technology encompasses all elements associated with IT and communication technologies, such as internet technology, which encompass the employment of hardware as well as software as well as its accessibility in a firm, workgroup or division. Additionally, the significant aspects are related to the performance of the tools. Therefore, although the technology infrastructure may be accessible and sufficient, it is insignificant if it is unable to carry out the necessary functions. This stage, the appraisal of the readiness of technology as to concern at least the technologists and researchers concerned with developing the new theory and autonomous reviewers standing for the management of an organisation, in addition to technically proficient agents of potential customers for the new technology (Meredith and Mantel Jr, 2011).

The last stage is organisation readiness assessment. The purpose of this stage is identifying the company's role in the digital market, and the internet-based services and products which are relevant for the company's customers. Selection of scenario, connectivity objectives, strategic responses and finally, selection of competitive e-business solutions are steps for formulating an e-business strategy (Jutla, Craig et al., 2001; Daemen, 2002; Alhawamdeh, 2007).
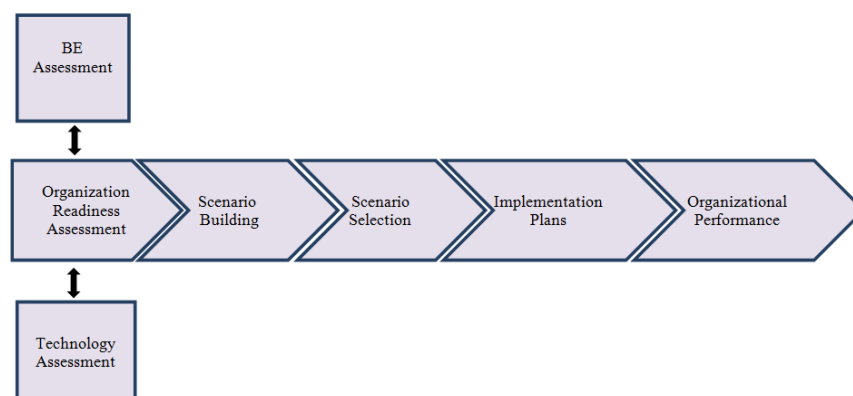
Figure 3-2: e-Business Strategy Process

e-Business Model of the Research

The application of e-business makes reference to the implementation of the management of intra- and inter- organisational business processes though communications and computing that are Internet-based (Zo et al., 2006). In addition to rapidly changing the manner in which firms buy, sell and deal with customers, e-business is becoming an essential element of its business strategy (Abu-Musa, 2004).

Efficient diffusion and adoption of e-business varies from the use of a traditional information system in at least two ways (Lin, 2008). Initially, e-business is complicated, comprising new technologies that may provide a broad variety of functionality, varying from advancing online business processes to enabling collaboration with business partners and customers (Zailani et al., 2009). It has been suggested by IS researchers that e-business may be regarded as one of the more important technological innovations (Paterson et al., 2003), which comprises managerial, operational and strategic benefits which include greater combination of internal and external process, as well as closer connections to business partners and customers (Burn and Ash, 2003). Second, e-business facilitates the performance of electronic transactions by the firm with any business partner with the value chain. Therefore, e-business considerably influences the change of business process, diffusion innovation, as well as business transformation (Lin, 2008).

e-Business is a new means of managing commercial enterprises and associations with trading partners and mirrors a company's strategic objective which is to utilise the internet to facilitate transaction, share information and enhance customer service whilst reinforcing back-office combination (Lee et al. 2007).
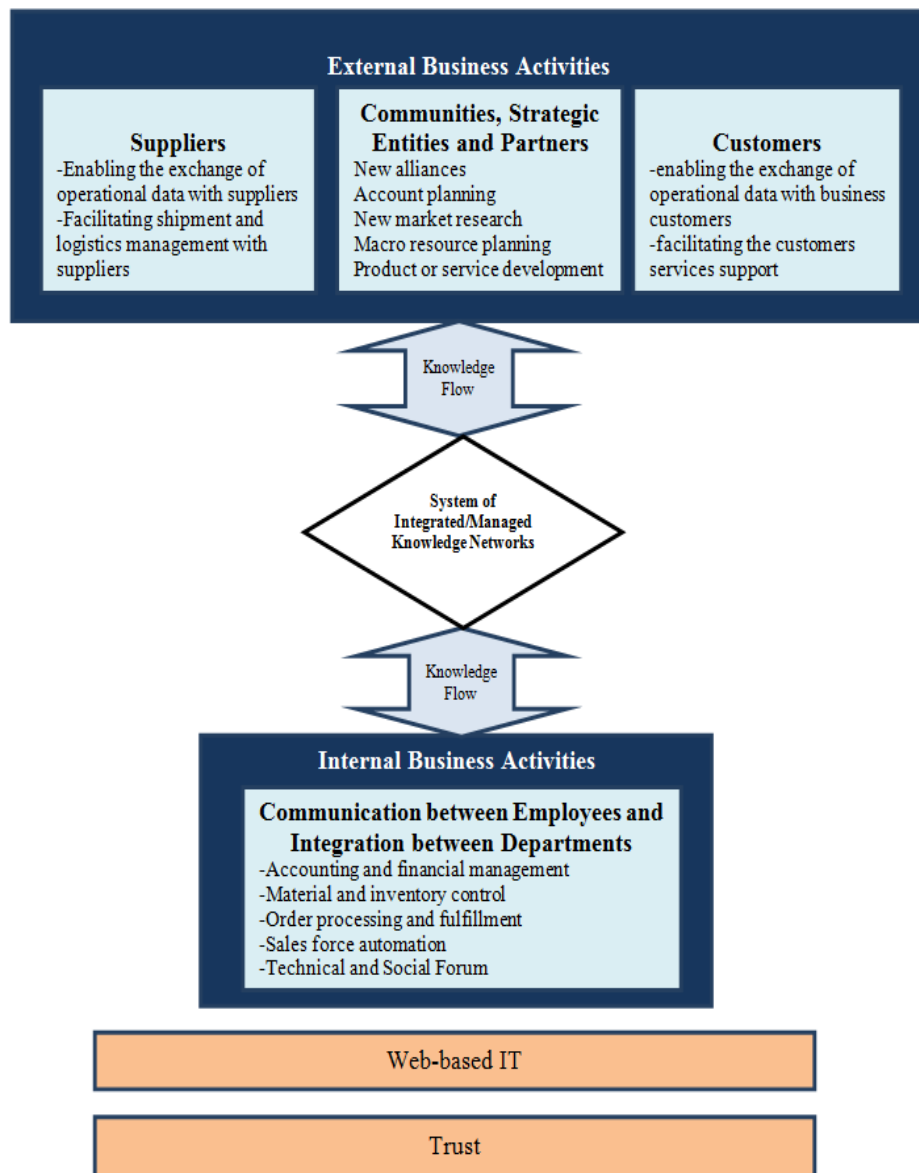
Figure 3-3: e-Business Model

Figure 3-3 is an e-business model which is the result of analysing and integrating 17 models (appendix 2) developed by researchers (i.e. Timmers, 1998; Chateau, 2000; Julta et al., 2001; Applegate, 2001; Porter, 2001; Miler 2001; Damen, 2002; Lowry, 2002; Vassilopoulou et al., 2003; Ash and Burn, 2003; Rappa, 2004; Jelassy and Enders, 2005; Daughfous, 2006; Alhawamdeh, 2007; Lin, 2008; Lin, 2011). Within this study, the definition of e-business is a web-based IT and employed by organisations to connect internal communication among staff, and integration among divisions and external cooperation with customers, suppliers, communities, strategic partners and entities within an organisation.

The Research Model

The research model (Figure 3-4) is derived from the analysis of the relationships between KM, e-business and KBO models which have been designed separately. According to the literature review, e-business strategy addresses how employees, departments, suppliers, customers, communities, strategic entities and partners and their activities can be enabled by web-based IT in an organisation (Julta et al., 2001; Chaffey, 2007; Janssen et al., 2008). On the other hand, e-business strategy is aligned with the organisation's strategies and business processes via IT (Maahlo et al., 2012). In fact, the web-based IT is the core of an e-business strategy which helps to build the knowledge networks, and facilitates the knowledge flow in an organisation (Bremser and Chung, 2006; Sorenson, Rivkin and et al., 2006).

Figure 3-4: Research Model

KM strategy is the other part of the research model. It is a scheme that details the manner in which an organisation manages its knowledge in an improved manner to the advantage of that organisation and its stakeholders (Choi et al., 2008); Also, KM strategy is aligned with the organisation's overall strategy and objectives (Chen and Liang, 2011). Knowledge management systems (KMS) are the core of KM strategy (Halawi et al., 2006) that includes sourcing a

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professional or a documented origin of knowledge with the assistance of online directories and searching databases; knowledge sharing and collaborating in virtual groups; availability of data from previous projects; and finding out about customer behaviour and requirements through evaluation of transaction information, among other things (Hsia et al., 2006). Therefore, KMS helps to build the communication networks in an organisation.

When knowledge is created, knowledge networking comprises the fundamental procedure to create new knowledge. Networking knowledge may generate a portion of knowledge which has information value that extends past the simple total of the individual portions, i.e. it results in new knowledge. Using the Web, the organisation has a basic infrastructure in position enabling the connecting of information on an international scale. Knowledge is the core of an organisation's progressively more activities of digital services; linking information forms the foundation of organisational productivity (Decker and Hauswirth, 2008).

The theory of e-business strategy has been initiated to deal with the matter of the manner in which the internet can restructure firms and offer competitive advantage. Contributors detailed the various viewpoints of the challenge, ranging from business models to management, and from marketing to operations (Urban and Brynjolfsson, 2001). In fact, an obvious e-business strategy has provided orientation for the firm, defining it as a banner for the entire organisation to unite beneath (Jackson and Harris, 2003). Normally, fruitful utilisation of e-business necessitates creating an inventive connection linking the strategy of the organisation and technology reinforcing it, and controlling persistent information and communication technology applications which are progressively convergent and integrated, and which enable adaptive and flexible behaviour from the company and its stakeholders (Sohal and Dubelaar, 2005).

When networked and communicated knowledge emerge from knowledge management, and integrated knowledge based networks result from e-business interactions with each other, the outcome from the interrelation of these two dimensions is an e-enabled network of knowledge which brings the knowledge from the inside and outside of the organisation together to serve the organisation's growth and improved performance, and ultimately its competitive advantage. The organisation is subsequently expected to identify the characteristics of a KBO.

The successful adoption of knowledge management and e-business systems when e-enabled knowledge network is implemented requires the development of the internal competencies (Chaston and Mangles, 2002; Fiers and Williams 2003). Three dimensions of internal competencies are identified in an organisation that facilitates the adoption of knowledge management and e-business systems including: 1) the individual dimension which includes: awareness (Boyatzis, 2008), trust (Hayton and McEvoy, 2006) and personality (Geoghegan and

Dulewicz, 2008); 2) the technological dimension which includes: tools and infrastructure (Knezek and Christensen, 2008); and 3) the organisational dimension which includes: structure (Tyagi and Sawhney,2010), culture (Cameron and Quinn, 2011) and work process (Cardy and Selvarajan, 2006).

As mentioned in the KBO model, a knowledge-based organisation is an ICT and web (e)-enabled organisation which uses knowledge through a process of acquisition, distribution and utilisation to lead to innovation, learning, effective communication and efficiency in the organisation. Also, as explained, an organisation may acquire, distribute and utilise knowledge through web-based systems (Sivenco, 2008), but if this knowledge cannot lead to innovation (Darroch, 2005), organisational learning (Kanchana et al., 2011), absorptive capacity (Liao et al., 2007), value chain (Danskin et al., 2005), agility (Sherand Lee, 2004) and resilience (Alavi et al., 2006), this organisation is not considered a knowledge-based organisation. As a result, when e-enabled knowledge networks are in place, they lead to the creation, improvement and development of the strategic capabilities in the organisation; it can be expected that the organisation will be transformed into a knowledge-based organisation.

Strategic capability is described as the collection of resources, skills and capacities which construct long-term competitive advantage for a company (Jalonen and Lonnqvist, 2011). It comprises the capability to work in the direction of a vision constructed on the value adding aspects applicable to the company and a plan for revenues that has the correct balance amid making the most of short term opportunities and long term actions in order to attain sustainability in business. According to the literature and the KBO model, the strategic capabilities are innovation, organisational learning, absorptive capacity, value chain, agility and resilience in the organisation.

When an organisation is transformed into a KBO, the strategic capabilities arising from e-enabled knowledge networks are expected to have considerable impacts on the company's performance. Organisational performance is constituted of the real output or outcomes from an organisation as measured against its aimed outputs (objectives and goals) (Liampreecha and Chamnanchang, 2013). The most important indicators for measuring organisation performance are divided two groups; financial and non-financial (Broadbent and Laughlin, 2009). An organisation can identify how much e-enabled knowledge network has been successful when financial indicators measure the financial statements and documents. Financial performance indicators measure and demonstrate organisation revenue such as amount of sales and profit and cost of operations (Moneva et al., 2007). On the other hands, non-financial indicators are not easily recognised in organisations. They demonstrate organisation performance through

measuring factors such as customer satisfaction, market share and time of operations (Coram et al., 2011).

The Core Questions

According to the research model and the research objectives and questions, this research is seeking answers for the following core questions:

- How e-enabled knowledge networks assist organisations in achieving the characteristics of a KBO through facilitating the flow, assimilation and application of knowledge, from outside and inside the organisation, by devising and implementing e-business and KM strategies?

- How e-enabled knowledge networks assist an organisation to become a KBO?

- What effects should be expected in the organisation's performance both in terms of strategic capabilities and general performance as the result of development of e-enabled knowledge networks?

- What are individuals', organisational and technological barriers to achieve such integration and becoming a KBO?

Propositions

The model as presented above provides a number of propositions which will be the subjects for the field study in the oil and gas industry. The propositions have been designed based on e-business, KBO and research models in accordance with the literature review and the framework of the research.

Normally, successful utilisation of e-business necessitates generating a creative connection linking the strategy of the organisation and the technology reinforcing it, and managing persistent information and communication technology applications which are progressively convergent and integrated, and which enable adaptive and flexible behaviour from the company and its stakeholders (Dubelaar and Sohal, 2005). Basically, e-business is from a considerably wider concept and is related to employing the internet and associated technologies to redesign and integrate the internal activities of an organisation, its processes and external relationships,

and form new methods of working that are considerably varied from, and usually quite superior to, what was possible previously. Alternatively stated, e-business is to develop new methods of working by creatively using the new possibilities of ICTs overall and internet-based technologies especially (Feng, 2007). e-Business is a new method of managing enterprises and relations with trading partners, and reflects the strategic intention of a company to employ the internet for sharing of information, facilitating transactions, enhancing customer service and reinforcing integration of back-office (Lin, 2008).

The application of e-business makes reference to the implementation of communications and computing that are internet-based to manage inter- and intra- organisational business processes. In addition to speedily transforming the manner in which firms buy, sell and trade with their customers, it is additionally becoming an essential element of its business strategies

Jelassi and Enders (2005) describe e-business as "the utilising of electric methods to carry out an organisation's business externally and internally". Activities of internal e-business encompass the connection of an organisation's staff with one another by means of an intranet to enhance dissemination of knowledge, enable spreading of knowledge, and support managerial reporting. e-Business activities additionally encompass supporting after sales activities and coordinating with business partners (Jelassi and Enders, 2005).

Thus, we suggest the subsequent propositions:

P1: Clearly developed and communicated strategy for e-Business will lead to development of integrated networks, which facilitate communication and flow of knowledge within the organisation and with its external environment. As a result the following outcomes are also expected:

P1-1: Sound and appropriate technology is adopted and implemented

P1-2:Integrated development of functional and operational information within the organisation (individuals and departments) is facilitated.

P1-3: Exchange of operational and logistical information with suppliers is facilitated.

P1-4: Exchange and sharing of strategic and operational information with external partners and communities is facilitated.

P1-5: Clear communication and exchange of information with customers is facilitated to support customer services and keep them satisfied.

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Companies may be more innovative, attain improved financial outcomes, enhance processes and develop HR abilities with a clear KM strategy. And, alternatively, those advantages enable the connection of innovation-performance (Lopez-Nicolas and Merono-Cerdan, 2011). Using knowledge management as a foundation for the innovation process encourages to create and exchange knowledge by providing collaboration and communication with a person-to-person method (Greiner et al., 2007). This seems to be particularly appropriate for complicated, unstructured and special processes. This approach has been selected by organisations for resolving new challenges, creating customer particular resolutions, and developing product innovation. Regarding the 'treasures stored in the minds of the employees' (organisation representative), the tacit knowledge is the key strategy of the personalisation. The aim is to employ KM so as to enable innovation which builds an alternative strategy requisite to enable effectiveness of processes. The immediate exchange of tacit knowledge by means of socialisation is essential for the creation of knowledge and the innovation process (Semeon et al., 2013). The strategies of knowledge management are placed within three groups. These comprise acquisition, retention and exploitation of knowledge. Any process which supports one of these three aspects of KM may be viewed as a KM process. There are various means for knowledge acquisition, channels for knowledge distributions and modes for knowledge utilisations. The concentration of considerable endeavours on KM has been on the development of one or more of these processes, while not being obvious regarding the strategy aspect any specific process is intended to support. That is, although it could be intuitively obvious regarding which processes may be utilised in an organisation, it is quite vague as to the manner in which strategic objectives could be converted into suitable processes (Beckett, 2000). Thus, there is an advantage to categorising KM processes, to outline the connection linking KM strategy and KM networks. Thus, we put forward the following proposition:

P2: Clearly developed and communicated strategies for knowledge management will lead to realised and communicated knowledge within the organisation (through a KMS). As a result the following outcomes are also expected:

P2-1: Knowledge is acquired through various means, distributed through various channels, and utilised in various modes and areas.

P2-2: Knowledge is networked and shared with stakeholders, within the set strategies and policies, through set up e-enabled networks.

Technology functions as a catalyst or accelerant for the initiation and primary acceptance of a knowledge management program, but so as to be successful, this accelerated implementation is required to be aligned with a defined KM strategy and supported by a change program (Tsui, 2005). Technology infrastructure comprises the IT instruments (i.e. hardware and software) that facilitate any kind of electronic encoding as well as exchanging of information. Organisational structure is the manner in which staff are arranged into teams (formal and informal), and communicate within teams; the group of functions and objectives of every team, and the manner in which it is being associated with organisational strategy. Corporate culture comprises the mutual norms and values, and ethics and practices within the organisation. Knowledge encompasses all kinds of knowledge (i.e. tangible as well as intangible) that are found inside an organisation and its people. People comprise the internal as well as external stakeholders of an organisation, but with employees comprising the key factor of organisational knowledge management system (OKMS) (Yahya and Goh, 2002). Also, e-business makes the standard communications platform for all internal and external business collaboration and knowledge networks (Warkentin and Bapna, 2001). Therefore, the researcher put forward the following propositions:

P3: Clearly developed and communicated strategies for e-Business and KM when aligned, will lead to development of strategic knowledge resources in the form of knowledge networks. As a result the following outcomes are also expected:

P3-1: Integrated KMS will facilitate interactive access of stakeholders (individuals, departments, suppliers, communities, partners, customers) to the knowledge.

P3-2: Shared platforms (technology and systems) are provided to facilitate access to the knowledge.

When networked and communicated knowledge arise from knowledge management, and integrated knowledge based networks arise from e-business interact with each other, the outcome through this interaction is an e-enabled network of knowledge, which brings the knowledge from inside and outside of the organisation to serve the organisation's growth and improved performance, and ultimately competitive advantage. The successful adoption of knowledge management and e-business systems when e-enabled knowledge network is made requires development of internal competencies (Chaston and Mangles, 2002; Fiers and Williams 2003). Three dimensions of internal competencies are identified in an organisation that facilitate adoption of knowledge management and e-business systems: 1) individual dimension which

includes: awareness(Boyatzis, 2008), trust (Hayton and McEvoy, 2006) and personality (Geoghegan and Dulewicz, 2008); 2) technological dimension which includes: tools and infrastructure (Knezek and Christensen, 2008); and 3) organisational dimension which includes: structure (Tyagi and Sawhney,2010), culture (Cameron and Quinn, 2011) and work process(Cardy and Selvarajan, 2006). Therefore, the current situation of organisation's three levels (dimensions of internal competencies) should be studied and the barriers removed for making an e-enabled knowledge network. Then, the e-enabled knowledge network leads to what changes in the three levels in the organisation when it transfers organisation to a KBO. Consequently, the researcher puts forward the following proposition:

P4: e-enabled knowledge networks will lead the organisation to become knowledge based at:

- Individual level:

- Organisation level

- Technology level

Strategic capability is described as the collection of resources, skills and capacities which construct long-term competitive advantage for a firm (Jalonen and Lonnqvist, 2011). It comprises the capability to work in the direction of a vision constructed on the value adding aspects applicable to the company and a plan for revenues that has the correct balance amid making the most of short term opportunities and long term actions in order to attain sustainability in business. According to the KBO model, the strategic capabilities are innovation, organisational learning, absorptive, value chain, agility and resilience in the organisation. In fact, strategic capabilities are the characteristics that classify an organisation as not being a knowledge-based organisation if it does not have them. As mentioned in the literature review and the framework of the research, an organisation can acquire, distribute and utilise knowledge through web-based systems, but this knowledge cannot lead to innovation, organisational learning, absorptive capacity, value chain, agility and resilience. Consequently, this organisation is not a knowledge-based organisation. Thus, we put forward the following proposition:

P5: e-enabled knowledge networks will lead to sustained strategic capabilities in the organisation:

- To create value and exploit market opportunities

- To respond to market and environmental changes in an agile manner

- To become a learning organisation

- To increase organisational absorptive capacity

- To become an innovation led organisation

- To bring about an increase in the rate of new product development and introduction

- To become resilient to unexpected changes (threats and crisis)

When an organisation is transformed into a KBO, the strategic capabilities arising from e-enabled knowledge networks are expected to have considerable impacts on the company's performance. Organisational performance is constituted of the real output or outcomes from an organisation as measured against its aimed outputs (objectives and goals) (Liampreecha and Chamnanchang, 2013). The most important indicators for measuring organisation performance are divided two groups; financial and non-financial (Broadbent and Laughlin, 2009). An organisation can identify how much e-enabled knowledge network has been successful when financial indicators measure the financial statements and documents. Financial performance indicators measure and demonstrate organisation revenue such as amount of sales and profit and cost of operations (Moneva et al., 2007). On the other hands, non-financial indicators are not easily recognised in organisations. They demonstrate organisation performance through measuring factors such as customer satisfaction, market share and time of operations (Coram et al., 2011).

Therefore, we put forward the following proposition:

P6: e-enabled knowledge networks will lead to improved and sustained efficiency and performance of the organisation in terms of:

- Increased customer's satisfaction

- Meet and exceed market share

- Increased sales and profit

- Reduced cost of operations

- Reduced time of operations

CHAPTER 4: METHODOLOGY

Paradigm of the Research

There is a long-standing epistemological discussion between scholar of social science and methodologists on best ways to conduct research. Two different thought schools are in the centre of this discussion; positivism and interpretivism paradigms (Silverman, 1998). Positivism paradigm uses experimental and quantitative research methods to evaluate hypothetical deductive generalisations. This paradigm explores fundamental laws and causal explanation. Interpretivism paradigm uses naturalistic and qualitative research methods to holistically and inductively comprehend human experience in specific context settings. It also attempts to clarify and understand a phenomenon, rather than find fundamental laws and external causes (Amaratunga et al., 2002).

The interpretivists reject the beliefs of positivists, which use regularities to ground causations and generalisations (Tsang, 2014). Under interpretivism paradigm, the objective of organisational research is the theories development by explanatory research methods rather than the generalisation creation (O'donoghue, 2006).

According to two mentioned paradigms, research can be divided into two research methods, quantitative and qualitative (Bryman, 2012). The quantitative method has been developed from a rich academic tradition, which places considerable trust in numbers that signify concepts or opinions (Creswell, 2013). Some research methods of quantitative approach include cross-section, correlation, longitude, experiment and quasi-experiment. On the other hand, the qualitative method focuses on observations and words to clarify reality and tries to explain individuals in the natural situations (Silverman, 2006). And also, some research methods of qualitative comprise ethnography, case study, phenomenology and biography.

Qualitative researchers believe that it is human interaction as opposed to governing laws that determines social phenomena (Pan et al., 2007). This is the constructivist ontology, which attempts to make sense of the manner in which interaction and intersubjective meaning are able to create a social phenomenon (Healy and Perry, 2000). Researchers using qualitative methods are of the opinion that social actors through interactions create the social world, whereas objectivists are of the view that individual actions and behaviour are based on social structures determine (Bryman, 2004).

An interpretivist epistemology must be used when studying this constructivist ontology (Tuli, 2011). Hence the essential principles of qualitative research will be grasped by the study.

Sociologists strive to make sense of the manner in which individuals construct meaning through interpretivism and use an inductive form of inquiry to understand how. Subjectivity is extremely crucial for interpretivists and they try to gain Verstehen (Williams, 2000). This is due to the inherent subjectivity of human beings (Garcia and Quek, 1997). They view value neutrality as redundant as it is not possible to achieve Verstehen without applying qualitative methods (Taylor and Lindlof, 2010).

First and foremost in order to carry out qualitative research, researchers must choose a field of research and research questions, accordingly the kinds of questions they choose will determine their research (Becker et al., 2012). There is no need for an initial hypothesis with qualitative research as it is inductive in nature, different from quantitative research (Bryman, 2004). This can be explained by the fact that behavioural and socio-cultural patterns arise over time and in are sometimes not recognised till after the study has been concluded (Mason, 2006). Once the field of study has been chosen, researchers must then choose the setting of the research and decide on the methodology (Bryman, 2004).

The micro sociological context is examined in qualitative research (Kelle, 2005). In other words, qualitative researchers prefer to deal with individuals within their natural surroundings; meaning that qualitative research is context specific. The value of the social is the focus of qualitative research and it attempts to provide explanations by studying the interactions between variables (Silverman, 2006). By producing accounts from on-site observations and interviews, qualitative researchers aim to grasp and discover social situations. They focus on themes and understanding patterns (Sandelowski, 2000). The world consists of complex elements such as; feelings, values, symbols, inspiration, thought procedures, moods, patterns and themes, qualitative researches focus on these elements (Corbin and Strauss, 2014). The purpose of qualitative research is to gain an understanding of the world by obtaining meanings through participants' eyes (Golafshani, 2003).

Through the use of qualitative methods, researchers can provide comprehensive explanations and reports of socio-cultural phenomena, which do not have to be depicted in quantitative form (Bryman, 2004). On the contrary, quantitative, positivist, deterministic studies apply results to the entire population and strives to be decisive by discerning governing laws (Slife and Melling, 2012).

The questions of this study are exploratory in nature, and the main objective of the research is to conduct an exploratory study of knowledge management practices and e-business systems across a range of energy companies. This study employs a qualitative research method for the investigation of the research problem, which corresponds with interpretivist paradigm.

Case Study

As a key method of qualitative research, case study has been widely adopted in knowledge management (Pan and Scarbrough, 1999), information systems and e-business management (Bandara et al., 2005).

Yin (2013) mentions that case study is distinct from other kinds of research methods of social science as a situation in which: why or how questions are being raised and the researchers have minimum control on events and focus on existing phenomena in a context of real-life. Bandara et al. (2005) emphasise that case research is one of the most powerful research methods in information systems and e-business management particularly when developing new theories.

Case studies are rich because they are empirical descriptions of specific examples of a phenomenon, which are normally based on a variety of data sources (Yin, 2009). Also, making theory from case study can be a strategy when one or more cases are involved to make theoretical constructs, midrange theory and/or propositions from empirical, case-based evidence (Eisenhardt, 1989).

This study aims to conduct an exploratory study of knowledge management practices and e-business systems across a range of energy companies. The study employs a qualitative research method for the investigation of the research problem, which corresponds with the interpretivism paradigm. Therefore, a qualitative research methodology was designed that its method is case study. This research aims to explore the relationships between KM and e-business strategies when an organisation is transferred to a KBO. The researcher established the conceptual framework through an intensive literature review and studying previous research. The conceptual framework needs to be further developed and tested from the practitioners view. Rich empirical data is required in order to establish an overall picture from practitioners' point of view. Case study is the best suitable method to achieve the goal since it is a powerful research method used to develop new theory by extracting rich, reliable information from a variety of data sources. Yin (2009) submitted that this case study has six sources of evidence. These comprise participant observation, direct observation, interviews, documentations, physical artefacts and archive records. In this study, the researcher uses interviews and secondary data (documentations and archive records).

The field of this research is the oil and gas industry; it is a strategic and key industry in the world. The oil and gas markets are different from other markets. Some outstanding features of the oil and gas industry include competing on technology and not on product; competition is on knowledge of the applied technology in exploring, exploiting, developing and maintenance; and

Rapid changes in new technology, new partners, merging and outsourcing (Bratvold et al., 2007).

According to OPEC data taken at the start of 2014, Venezuela hosts the biggest oil reserves as well as non-conventional oil deposits (20% of global reserves), Saudi Arabia (18% of global reserves), Canada (13% of global reserves), and Iran (9% of global reserves). Furthermore, BP data taken, at the end of 2014 indicated that Iran (18.2% of global reserves), Russia (17.4% of global reserves), and Qatar (13.1% of global reserves), were dominating gas reserves hosting close to half of the world's known reserves (BP Statistical Energy Review, 2015). Furthermore, Middle East countries have 66% of oil proven reservoirs and 43.10% of gas proven reservoirs (OPEC Annual Report, 2014) in the world and big national oil companies are managing, supplying and exporting the oil and gas resources such as Aramco (Saudi Arabia) and NIOC (Iran).

For that reason, the National Iranian Oil Company (NIOC) and National Iranian Gas Company (NIGC) were carefully chosen for this study. These energy companies work in an oil-based economy country (Iran). Their activities are quite comparable to other oil and gas companies as their main objective is exploration, exploitation and selling oil and gas. Apart from technology, especially in the Middle East where many oil and gas companies are active, almost organisational cultures are also very similar (Marcel, 2006). Additionally, the target population of the research are including managers, experts and some people who are involve in the organisational processes (especially KM and e-business systems).

As discussed in the literature, the oil and gas industry categorised into three parts; upstream, mid-stream and downstream.

- Upstream: this sector includes exploration and development of the oil and gas fields,

- Midstream: it includes refining and processing operations of the crude oil and gas, transportation of them through tankers, pipelines, rail and trucks; storage of the oil and gas to facilitate distribution and finally, technological applications for improving effectiveness and efficiency of the oil and gas processes and activities,

- Downstream: the last sector is Gas (LNG, CNG and GTL) distribution and sale, Oil products (Petrol, Diesel, etc.) storage and distribution.

In respects with widespread activities of the oil and gas industry, many oil and gas companies are working in upstream, midstream and downstream parts. Therefore, selection of the companies is difficult. As a result, a model or pattern was required that researcher can select the

appropriate companies and subsidiaries for doing this study. Consequently, the research uses model of Bain and Company as a popular model in oil and gas industry to select companies and SBUs, which should be studied.

Bain and Company is an American (global) management consulting firm with focus on services such as structure design, training and other aspects of organisational activities in oil and gas companies in the world (Van Teeffelen and Uhlaner, 2010). Organisational structures of NIOC and NIGC have been designed based on the Bain model. The model has divided each oil and gas company to four parts (Rigby and Bilodeau, 2013): EDP (Exploration, Development and Production), investment, supply Chain and; business and Marketing.

When Bain and Company's model was selected, the required subsidiaries of NIOC and NIGC should be divided into four categories of the model. Because the number of the subsidiaries were high and they should be identified as the cases of the research; therefore the model could assist to select them. As a result, an expert panel was formed, which had included managers and academic and non-academic experts of the oil and gas industry. In the next part, the expert panel and its members and outcomes will be explained.

The research methods have been used in this research, are demonstrated in Figure 4-1 summarily. The components of the figure have been explained in this chapter.
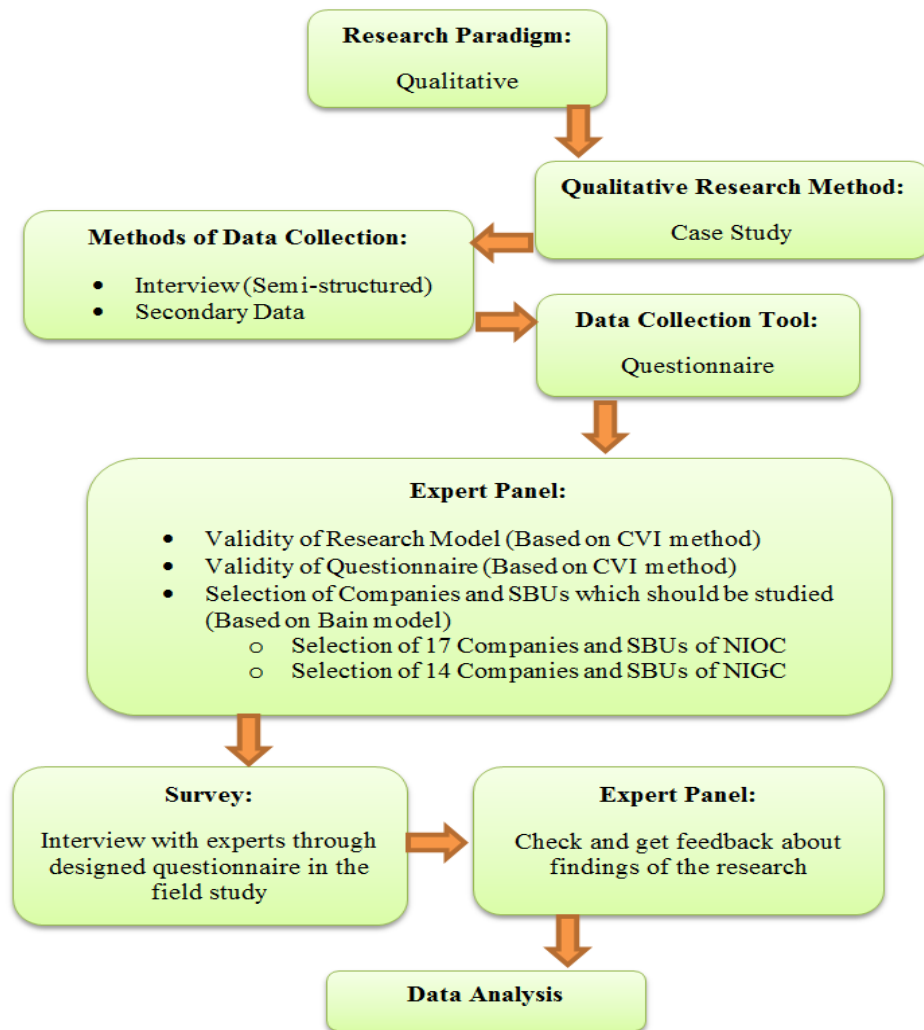
Figure 4-1: An overview of the research methodology

Interviews

Qualitative methods are one advantage for exploratory studies because they make use of open-ended questions and probing provides respondents with the chance to reply in their own words, as opposed to forcing them to make the choice between fixed responses like in quantitative methodologies (Pross, 2010). Open-ended questions can induce answers that are (Nicoleta and Gabriel, 2012):

- Expressive and important to the participant in cultural terms

- Unexpected by the investigator

- Explanatory and rich in nature

Qualitative methods are also advantageous because they enable the researcher to investigate initial participant responses by asking how or why (Loewenthal, 2011). It is important for researchers to pay close attention to what participants say and interact with them in accordance with each of their different characters and styles, and make use of probes in order to get them to expound on their responses.

Therefore, interview is the research method of this study. Because, interview helps the research to achieve the following objectives:

- To evaluate KM and e-business systems that are aimed at individualised outcomes

- To capture and describe different processes of knowledge-based organisation

- To explore networked and communicated knowledge between experiences and outcomes of experts

- To evaluate KM and e-business systems that are seen as dynamic or evolving

- To understand the meaning of technological infrastructure for KM and e-business

- To document variations in program implementation at different sites

In order to understand the reasons behind the answers given in the questionnaire, explore an in-depth the interviewee's own perceptions and to gain in detail understanding and more accurate data, this study has used a semi-structured interview.

The required data of this research has been collected by interviews that are carried out through a semi-structured questionnaire. When the final model of the research was designed and the core questions and the propositions formulated, the next step was to design the questionnaire to examine the field of study. For this reason, a draft of the questionnaire was prepared and modified to suit for the purpose of the study.

The final questionnaire (appendix 3) has three main parts, personal information, organisation/unit information and the research questions. The personal information refers to the general information about the interviewee such as name, address, position in the organisation, some of which are optional. The organisation/unit information contains questions about mission, vision, objectives and strategies of the organisation and some questions with respect to the success of interviewee during their work in the organisation.

The third part of the questionnaire collects the required data in accordance with the designed research model and research propositions. This part has four sections; e-business, knowledge management, aligning e-business and knowledge management and finally, e-enabled knowledge networks. The first section, e-business is divided into philosophy and objectives of e-business in the organisation of the interviewee, the results that are met when the company have e-business and barriers which prevent to implement e-business (and related issues).

The second part refers to KM, which like e-business is divided into three parts of philosophy and objectives of KM, results and barriers.

Aligning KM and e-business is the third part. It surveys relationship between KM and e-business and study the results of alignment and misalignment of them and also barriers and drivers, which affect this relationship.

And the final part is e-enabled knowledge network that is in actual fact the most import part of my survey; because the previous parts should not be answered till finding answers to the research questions. The definition of e-enabled knowledge network and its impacts on organisation's capabilities and organisational performance are the issues, which will be asked from the interviewees.

Expert Panel

Stage One: Before the Survey

In order to ascertain validity of the questionnaire items to be used in the field, the process of content validity has been applied in the research. The content validity relies upon the judgment of an expert panel (Sangoseni et al., 2013). The expert panel member must possess extensive knowledge and demonstrate a good grasp of the subject being explored (Hatcher and Colton, 2007). The adequacy of the final content of the test instrument would be based on the collective opinion of these experts based on their professional assurance. The modified instrument is evaluated to determine the extent to which each item appears to be a valid measure of the attribute it is meant to measure.

Before beginning the interview of the research, the questionnaire was checked and approved by (academic and non-academic) experts of the oil and gas industry to determine whether it can cover the field of study or not? Which companies are more useful for this research in oil and gas industry? Who can answer more effectively and efficiently to these questions in the selected

companies? After answering these questions, the interviews could begin. For this purpose an expert panel was formed for which seven experts with relevant experiences between 15 and 30 years were identified and invited to support the study, who responded positively and contributed to the panel. The experts were included the technology manager of NIOC (National Iranian Oil Company), the human resource manager of NIOC, the organisational structure manager of NIGC (National Iranian Gas Company), the manager of research and development of human resource (NIGC), the manager of KM projects of IIES (International Institute for Energy Studies), and the manager of organisational structure design projects (IIES).

The members of the panel were given a delineation of the questionnaires' entire content domain, with precise questions relating to each item's content significance of, resultant founded on the ratings of the content significance of the items of the questionnaire. With respect to the level of validity for every question, a 4-point ordinal rating scale was used, where 4 point means "very relevant"; 3, "somewhat relevant"; 2, "hardly relevant" and 1, "totally irrelevant".

The ratings of the content significance of the questionnaire items formed the basis of the index of content validity (CVI) (Polit et al., 2007). The percentage of items (questions) in the questionnaire that the experts gave a 3 or 4 rating is the CVI. Items with a CVI of less than 0.83 were not included in the questionnaire. Therefore, items which more than 80% of the experts thought were valid were chosen as relevant. The literature and the expert panel's recommendations were then used to eliminate or revise other items.

The experts in the panel discussed and approved the following key items:

1. NIOC and NIGC are two famous energy companies in the oil and gas industry, but petroleum ministry of Iran is not a strong representation of the industry, while all key managers of NIOC and NIGC are appointed by the petroleum ministry. On the other hand, oil and gas companies and energy organisations are using the brand and name of NIOC and NIGC in their reports. Consequently the researcher opted to take the panel's suggestion and only undertake the study of NIOC and NIGC as the target companies.

2. Bain & Company is an American company for oil services such as structure design, training and other aspects of organisational activities in oil and gas companies in the world (Van Teeffelen and Uhlaner, 2010). The organisational structure of NIOC and NIGC has been designed from Bain model. The Bain Model has divided each oil company to four parts (Rigby and Bilodeau, 2013):

   • EDP (Exploration, Development and Production)

- Investment

- Supply Chain

- Business and Marketing

Therefore, the research uses the Bain Model as a popular model in oil and gas industry to select companies and SBUs, which should be studied.

Strategic Business Units (SBUs) and subsidiaries of NIOC were selected in four categories as have been demonstrated in Table 4-1.

Bain's Category	Subsidiary / SBU
EDP	Management of Exploration Pars oil and Gas Co. Petroleum Engineering & Development Company (PEDEC) Management of Technology National Iranian Oil Production Distribution Co. (NIOPDC) National Iranian Oil Refinery and Distribution Co. (NIORDC) Iran Oil Pipelines and Telecommunication Co. (IOPTC)
Investment	Management of Planning
Supply Chain	Management of Export and international Affairs Manufacturing Support & Procurement Kala Naft Company
Business and Marketing	Management of HSE (Health, Safety and Environment) Management of Human Resource (HR) Institute for International Energy Studies (IIES) Division of KM (Knowledge Management) Management of R&D (Research & Development) Research Institute of Petroleum Industry (RIPI) Management of Structure

Table 4-1: The selected subsidiaries based on Bain Model for NIOC

3. SBUs and subsidiaries of NIGC selected in four categories as they have been demonstrated in Table 4-2.

Bain's Category	Subsidiary / SBU
EDP	Management of Coordination & Supervisory of Production Management of Dispatching Management of Distribution Iranian Gas Engineering and Development Co.

	Iranian Gas Transmission Co.
Investment	Management of Planning
Supply Chain	Management of International and Commercial affairs
Business and Marketing	Management of HSE (Health, Safety and Environment) Management of HR (Human Resource) Division of HR Training Division of KM (Knowledge Management) Management of Law Affairs Management of R & D (Research & Development) Management of Structure

Table 4-2: The selected subsidiaries based on Bain Model for NIGC

4. The relevant managers of the selected subsidiaries and SBUs based on the Bain model were identified to interview in NIOC and NIGC. The targets are the CEO, the director and the managers related to the selected companies and SBUs. Furthermore, the expert panel members identified planning managers when the researcher cannot access the CEO and the relevant managers, because the planning managers have the required information and are aware to all organisational activities.

5. The unit of the research in this study is organisation. In fact, the data collection does not include individuals and therefore the interviewees explain their knowledge and experience of their organisations. Consequently, the research can be classified as a case study method.

6. Here, it was cleared that the researcher does not intend to test the different components of KBO, KM and e-business models and also strategic capabilities and organisation performance in the research model. In fact, the researcher studies the components of the research model and search for proofs and instances of them in the SBUs and subsidiary companies of NIOC and NIGC.

7. Finally, the research model and the propositions were confirmed by expert panels' members through the index of content validity (CVI), which are adapted with the characteristic of oil and gas industry.

Stage Two: After the Survey

After analysing the data, a second expert panel was formed including: HR managers, R&D managers and KM managers of NIOC and NIGC and KM project manager of IIES as well. The findings of the research were explained to them. Some feedback was given and they approved that the findings were appropriate for their SBUs and companies of NIOC and NIGC. Finally, they also introduced some complementary resources related to the studied companies and SBUs, which assisted the researcher for finding the required information effectively and efficiently such as books, documents, CDs and websites.

Therefore, the main objectives of this expert panel comprise:

- Check and get feedback about findings of the research

- Introduce the complementary resources

The Field Study

As mentioned in the last part, 17 companies and SBUs of NIOC and 14 companies and SBUs of NIGC have been studied in this study. The interviews were carried out, but the researcher interviewed with more than 31 experts (about 75 experts). Because experts should be attended in the interview meeting individually; but some experts preferred to attend an interview meeting accompanied with their colleagues to achieve the better results from the interviews and to answer the questionnaire completely and properly. This led to the interviewees answering the questions clearly and precisely and the avoidance general information. In fact, the required data was collected from an expert group, which the manager led it as a supervisor. On the other hand, since the researcher had worked as a supervisor and consultant in different projects of NIOC and NIGC, this made a shared perspective in the interview meeting and avoided an academic atmosphere while they were answering to the questions and expectedly the required information was obtained properly.

Secondary Data

The required data for the research was collected via interviews as primary data of the research. Additionally, it was necessary to study some documents, books, reports, CDs and websites in

relation to the companies and SBUs of NIGC and NIOC and even other companies and organisations in relation to the required information.

Most sources of secondary data were confidential in NIOC and NIGC, therefore, different managers and authorities had to be met to issue the relevant permits for accessing the required data. This process was difficult and time consuming, because sometimes documents had to be studied in the company and they did not allow the documents to be copied or moved from the site and had to be used on the premises.

Research Context

The field of this research is the oil and gas industry; it is a strategic and key industry in the world. The oil and gas markets are different from other markets. Some outstanding features of the oil and gas industry include: Competing on technology and not on product; Competition is on knowledge of the applied technology in exploring, exploiting, developing and maintenance; and Rapid changes in new technology, new partners, merging and outsourcing (Bratvold et al., 2007).

According to OPEC data taken at the start of 2014, Venezuela hosts the biggest oil reserves as well as non-conventional oil deposits (20% of global reserves), Saudi Arabia (18% of global reserves), Canada (13% of global reserves), and Iran (9% of global reserves). Furthermore, BP data taken, at the end of 2014 indicated that: Iran (18.2% of global reserves), Russia (17.4% of global reserves), and Qatar (13.1% of global reserves), were dominating gas reserves hosting close to half of the world's known reserves. For that reason, the National Iranian Oil Company (NIOC) and National Iranian Gas Company (NIGC) were carefully chosen for this study. These energy companies work in an oil-based economy country (Iran). Their activities are quite comparable to other oil and gas companies as their main objective is exploration, exploitation and selling Oil and Gas. Apart from technology, especially in the Middle East where many oil and gas companies are active, almost organisational cultures are also very similar (Marcel, 2006). Also, the target population of the research are including managers, experts and some people who are involve in the organisational processes (especially KM and e-business systems).

In this parts, the profile of NIOC and NIGC and their subsidiaries have been studied as cases.

NIOC: The National Iranian Oil Company (NIOC) has been leading and establishing policies for the exploration, production, drilling, refining, distribution, research and development, and

export of gas, oil, and oil products since 1951. NIOC is among the world's biggest oil companies. It currently believed to have 137 billion barrels of liquid hydrocarbons and 29 trillion cubic meters of natural gas (NIOC History, 2012).

NIOC has become prominent thanks to technological developments and the intricacies of social, political and economic relationships. Consequently NIOC has national and provincial guidelines and collaboration with industrialised nations in the provision of energy and evening out global oil markets on its agenda (NIOC History, 2012).

In compliance with section 44 of the constitution the NIOC affords various sectors certain powers, whilst simultaneously managing and controlling the activities of the oil industry. The NIOC has carried out a wide range of tasks; it has made a great deal of progress with respect to launching business initiatives, it has sponsored developmental financial capitals , it has assisted to modernise equipment for exploration, production and drilling with dependence on the expertise of Iranian experts. Seventeen production companies, eight technical service companies, seven managements, six divisions (administrative units) and five organisational units make up the NIOC. At the present time, the NIOC has 54000 permanent members of staff; and over 78000 contractor staff workers (NIOC History, 2012).

A brief profile of the subsidiaries which have been selected for NIOC are explained in this part. The profiles are in the flowing tables.

Management of Export and international Affairs
Number of Personnel: 250 People Number of Subsidiaries: 7 Divisions - Administration and Protocol - Business Development - Crude Oil Marketing & Operation - Products Marketing & Operation - Financial affairs - Research and Planning - Claims and Insurance   Mission: NIOC-International Affairs, as one of the important directorates under the supervision of the state owned National Iranian Oil Company (NIOC), mainly deals with export and import of crude oil, petroleum products and their exchange. It is also engaged in tanker and storage tank chartering, stockpiling. Objectives: - Management, organisation and conduction of activities of NIOC and its subsidiary companies, both domestically and internationally.

- Monitoring the codification process of laws, regulations and resolutions for protecting the rights and interests of NIOC and subsidiaries.
- Evaluation of procedures and instructions of NIOC to adapt the legal conflict with their duties under the statute of subsidiary companies.
- Policy making and supervising of legal arbitration and litigation matters, both domestic and international and also, other dispute resolution services with executive agencies
- Monitoring the immovable property documentation of NIOC and its subsidiary companies
- Supervising the preparation of conventions, agreements and legal instruments binding on the national and international level and membership of relevant conventions.
- Policy and oversight of how to attract, maintain, strengthen, enhance and improve the performance of managers, directors and legal experts.
- Develop a policy and process for resolving contractual disputes.

Main objectives of International Affairs are:

- To achieve the best possible results under a reliable foundation made by our skilled colleagues who have obtained their experiences under difficult circumstances.
- To develop the business world-wide through our offices in: London, Singapore, Rotterdam, Beijing and Mumbai.

Management of HSE (Health, Safety and Environment)

Number of Personnel: 24 people

Number of Subsidiaries: 5 Divisions

- Safety and Fire
- Industrial work health
- Environment protection
- Planning of training and performance evaluation
- Crisis management and defend passive

Vision:

Remove all adverse effects of disasters, on people, the environment and Utilities

Mission:

Identification, assessment, elimination or control of the harmful factors for the health and safety of individuals, including employees, contractors and consultants, visitors, customers, etc.

Strategy:

Moving towards increase of productivity and manpower development through the use of national and international standards for sustainable development

Objectives:

- Protection of human resources, the prevention and reduction of occupational diseases
- Environmental protection and the prevention and reduction of environmental damage
- Safety of equipment for protecting company's assets
- Protection of the company's reputation

The strategies are in order to achieve these objectives:

- Develop a systematic approach to all activities in terms of HSE

- To be accountable for all levels of employees regarding laws, regulations and guidelines for HSE
- Reduce the risk of potential damage to the lowest possible and acceptable rate
- Principles of passive defence in all programs, projects and existing facilities
- Sustainable production and services in critical situations in compliance with HSE considerations
- Create an environment of open and constructive communication inside and outside the organisation and present of clear performance report
- Select contractors based on HSE criteria as one of the main criteria and their obligation to comply with HSE regulations and guidelines
- Promote science and culture of HSE in all staff through effective training and active its participation
- Support staff of contractors that the work stoppage in violation of HSE will have demand
- Consider HSE criteria for assessing the performance of the individual and the corporation
- Monitor the effectiveness of HSE management systems through periodic inspections and audits (as a preventive) and analysis of events and pseudo-events (the reaction)

Management of Human Resource (HR)

Number of Personnel: 400 People

Number of Subsidiaries: 2 Deputies

Deputy procurement and human resource development:

- Human resource planning
- Human resource training and equipment
- Administrative productivity and reform
- Supply of human resources
- Human resources research and development

Deputy of administrative affairs

- Sport and physical education
- Employment affairs
- Administrative services and welfare
- Contract services and contractors
- Social work and industrial relationship
- Information management system
- Plans, methods and administrative regulations

Mission:

Human resource development and strategic approach to attracting, developing, managing and motivating key resources or organisation that deals with the personnel.

Objectives:

- Supply of manpower
- Empowerment and effectiveness in achieving creativity manpower
- Nurture and develop the talents and skills of people
- Maintaining good relations between them and competent personnel
- Providing material and spiritual needs of staff satisfaction and reduce employee concerns so that personal goals are aligned with company goals

Strategies:

- Designing a knowledge management
- Educational Standards
- Standardising Services and Quality Management
- Institutionalizing recommendation system
- Development of sport among employees and their families
- Implementation of organisational processes with customer-oriented approach

Institute for International Energy Studies (IIES)

Number of Personnel: 250 People

Number of Subsidiaries: 10 divisions

Research divisions:

- Energy economics
- Management and HR
- Technological strategic studies
- Environment and laws

Other divisions:

- Research
- Training
- International
- Public relationship
- Security
- Administration

Mission:

Continuous analysis of the data, finding issue, research, theorising, decision-making and providing specialized training and strategic solutions to senior decision makers. in order to facilitate the activities of energy, especially oil and gas industry through using information technology, scientific and innovative methods, building synergetic and extensive network of national and international experts and comply with organisational values

Vision:

- Conversion of the Institute to a forerunner in strategic studies of energy, especially in the oil and gas industry
- Become the focus of an international network of strategic energy research
- Promote the institute to become a regional reference of the energy data
- Improve agility and organisational excellence in the world's top institutions
- Level of professional competency of human resources at the global level.
- National interests and Sustainable Development

Objectives:

- Study, research and consultancy in the fields of
  - Energy Economics at the national and international levels;
  - Study of energy in international markets, oil and gas developments especially.
  - Strategic planning in the oil industry;
  - Management and human resources in the oil industry;
  - Strategic management of technology and the future of energy fields;
  - Policies, energy policies and strategies of countries, international organisations and

companies;
- Improving productivity;
- Provide policy recommendations to decision-making authorities and top executive of the energy sector;
- Analysis of energy data;
- Accumulation of knowledge and conduct strategic research projects in the oil and gas industry;
- To promote and enhance scientific researchers, managers and professionals in the oil and gas industry through courses, workshops and seminars, publication of scientific and technical books, articles and journals;
- Conferences and scientific meetings at international and national levels,
- Develop partnerships with private companies in the energy field, in order to explore ways of assimilating scientific and research activities in the area of macroeconomic policy in the oil and gas industry, particularly the country's energy
- Guidance and support of the graduate research in regards to oil and gas industry

Division of KM (Knowledge Management)

Number of Personnel: 5 People

Mission:

Supervisory and control of gathering, categorising, analysing and exploiting the explicit and tacit knowledge of organisation and the subsidiaries

Objectives:

- Defining, designing and supervising the implementation of KM projects in NIOC and subsidiary companies.
- Define, design and supervisory of management system with intellectual property protection
- Develop cross-sectorial and international cooperation programs in the field of research and technology.
- Plan of interaction and cooperation of NIOC with scientific and technical companies, affiliated unions, societies and associations
- Develop programs of cooperation and networking with universities and research centres, including the polar categories, implementation of projects, graduate thesis and internship programs
- Setting up the project database
- Pole universities and research centres

Management of R&D (Research & Development)

Number of Personnel: 10 People

Number of Subsidiaries: 2 Divisions

- Planning and coordination
- Affairs of relationship with scientific centres and universities

Mission:

Formulate strategies of technology and research at National Iranian Oil Company, to institutionalize and expand the research activities, to build areas of growth, creativity and innovation in the oil industry, to provide programs of study, guidance and supervision of research projects of upstream and also, the coordination with universities, research centres, companies, and foundations of knowledge and technology parks.

Objectives:

- Planning and coordinating, including roadmap of research and technology, reviewing and approving plans and projects, research and technology, and how to allocate resources, to estimate the financial and human resources for research and technology
- The development of knowledge and technology include creation, development and localization of key technologies, technical knowledge in development projects
- To support commercialization, entrepreneurship, marketing and market makers including the planning and operation of market maker mechanisms, into policies and action plans that related to the formation of centres and institutes of technology and commercialization of the main companies
- Designing and supplying mechanisms for human resources, finance and infrastructure that are needed
- Infrastructure, network design and planning for scientific and technological mechanisms

Research Institute of Petroleum Industry (RIPI)

Number of Personnel: 350 People

Number of Subsidiaries: 6 Main Divisions

Research Divisions:

- Oil upstream development
- Oil downstream development
- HSE development

Other divisions

- Planning
- Technology and international relationship
- Logistic

Mission:

Research and Scientific services in petroleum and production of valuable products such as technical knowledge, patents and publication of papers in reputable magazines

Objectives:

- Following up and orienting PIRI's strategies and activities for the purpose of realizing (achieving) the objective of " lead-to-technology research"
- Promotion of national technologies, attraction of investment, creation of capacities, and development of required human resources for converting the science to technology
- Design of technological strategies and technological indigenization processes to confront the sanctions
- Contiguous interaction with operational body of the industry and fulfilling technological

needs for the industry
- Establishment, development, and cooperation with satellite science-based companies and science and technology parks for the purpose of extensive research and industrialization of research achievements
- Development and advancement of domestic and international relations and cooperation
- Increase in productivity regarding the available capacities and advantages of the organisation
- Access to long-term goals by optimum utilization of the resources

Strategy:

Strategies of PIRI are to create added value via production and commercialization of technology, with the approach of carrying out research for development of new technologies and indigenization of new technologies.

Management of Structure

Number of Personnel: 55 People

Number of Subsidiaries: 4 Divisions

- Centre of statistics and management information
- Planning and control of HR comprehensive system
- Job evaluation and categorisation
- Structure engineering and organisation studies

Vision:

Achieving the goals and mission of NIOC through designing organisations, systems, appropriate methods and procedures

Mission:

- Control the process of organizing, categorizing and evaluating jobs in order to adapt the system
- Determine the relationship between major and minor subsidiary companies, the authority system management of them
- Reform policies based on changes in NIOC such as divestiture of subsidiary companies, activities and environmental changes.
- Formulate the general principles for the preparation of the organisation, including production, marketing, human resources, etc. and integrating organisational system.

Strategies:

- Achieving the objectives and policies of Article 44 of the Constitution for changing role of government "ownership and direct management" to "guidance, policy and governance."
- Eliminate overlap and interfere with the functions and powers of organisations and different sectors of the oil industry.
- Maintain maximum control of organisation and estimation of the organisation size based on positions ergometer and standards.
- Value chain integration.
- Growth inhibition of irrational positions in the petroleum industry through placement of control mechanisms such as reforming salary and wage and also evaluating jobs and manpower planning.

Management of Exploration

Number of Personnel: 600 People

Number of Subsidiaries: 11 Deputies and Divisions

Deputies:

- Exploration
- Engineering
- HR
- Financial
- Exploration blocks

Divisions:

- R & D
- Planning and project control
- Upstream information system
- HSE
- Publication relationship

Mission:

Exploration & Techno-Economic Evaluation of new Oil & Gas Reserves in all of on-shore & off-shore sedimentary Basins of IRAN for development & Production purposes.

Many Hydrocarbon resources have explored during recent activities in EXP Directorate. According to this mission, investment processes on Exploration activities show high Economic results.

Vision:

Deep horizons of lower Paleozoic, unconventional hydrocarbon resources, and traps connected to Salt Plugs and Facies changes. Main challenges will be complicated G&G studies and high resolution 3D seismic.

Objectives:

- Emphasize on Common & Border line Oil & Gas fields Exploration
- New field Exploration to increase Reserve Replacement Ratio
- Deep Reservoir Exploration on Development & Production fields
- Oil Exploration adjacent to Productive fields for a faster development and to maintain the Productivity as well as decrease production pressure of Large-old reservoir (periodical anticline)
- Oil & Gas Exploration in lower Paleozoic Interval , Oil ring on Gas fields , Stratigraphic Trap & Salt Dams structures
- Individual Gas field exploration to petroleum replacement products(after Director confirmation)
- Exploration operation activities in all sedimentary basin of IRAN
- Exploration Success Rate maximization on new resource base on extended surveying & Mitigation of Risk & Cost on exploration Targets
- Doing Exploration steps by Internal experts
- Dealing to unconventional resource by Technical research (make no sense)

Pars oil and Gas Co.

Number of Personnel: 14600 People

Number of Subsidiaries: 30 Divisions

- Engineering & Construction
- Finance
- Administration
- Planning & Project Control
- Legal & Contracts Affairs
- Oil & Gas Engineering
- Oil and Gas Operation
- Logistics Manager
- Public Relations Department
- Procurement and Goods
- HSE
- Research & Development
- ICT
- Systems Engineering & productivity
- Security
- QA & QC Department
- Project of Phases 9&10
- Project of Phase 11
- Project of Phase 12
- Project of Phase 13
- Project of Phase 14
- Project of Phases 15&16
- Project of Phases 17&18
- Project of Phase 19
- Project of Phases 20&21
- Project of Phases 22&23&24
- Project of South Pars Oil Layers Development
- Project of Golshan & Ferdowsi fields
- Project of North Pars Gas Field
- Project of power plant and transmission lines

Mission:

POGC's mission is to ensure sustainable and preservative production and development of Iran's oil and gas industry in the areas under its responsibility, development of oil and gas value chain as well as optimization of energy supply processes at national, regional and international levels. POGC is also in charge of development of joint and non-joint oil and gas fields of the country including South Pars, North Pars, Golshan and Ferdowsi.

Objectives:

- Preserving national interests.
- Self-sufficiency in oil and gas industry related industries.
- Growth in GNI (Gross National Income).
- Creating job opportunities.
- Technology transfer.
- Creating motivation, encouragement and supporting companies and general contractors active in the oil and gas industries.
- Enhancing the share of local industries in construction and development of South Pars Gas Field.
- Preparing grounds for growth of Iranian manufacturers.

- Preparing grounds for growth of Iranian contractors and consultants.
- Technology promotion.
- Development of industrial, educational and scientific careers in the country.

Strategies:

- Operational agility and sustainable organisational superiority at domestic and international arenas, by using modern technologies, research, education, recreation and innovation, efficient interactions and communications as well as satisfaction of the beneficiaries,
- Application and development of eligible, talented, creative, innovative, committed, and accountable human resources who are also loyal to the company's ideals, objectives and values in order to create an outlook-oriented, learning, healthy, elevated and man's suitable organisation,
- Turning the company into a knowledge-oriented and elevated organisation through development of teamwork, promotion and improvement of quality and productivity on a regular basis, efficient exchange and sharing of information, establishing knowledge management, improving the production and operation management integrated system, and extension of the participation and consensus system and environment, development of capacities, organisational integration and synergy, improving the core eligibilities specially project management integrated system and eligibilities,
- Promoting the healthy and proactive organisational culture and atmosphere through strengthening mutual respect and trust, development of organisational and social co-understanding and cooperation, extension and motivation of a healthy lifestyle and boosting organisational pleasure and freshness,
- Sustainable development and preservative production of oil and gas and timely launching of products along with flexibility, speed, delicacy, safety and quality, development of the culture of accountability, follow-up and customer-orientation and upgrading the credit and position of the company at local and international levels,
- Preventing environmental pollutions and job accidents, management, mitigation and elimination of risks, preserving the company's assets, human and organisational capitals in good safe, upgrading the personal and organisational health and desirable fulfilment of social responsibilities,
- Compliance with all rules, regulations and standards applicable for the company's businesses and meeting other national and international requirements

Petroleum Engineering & Development Company (PEDEC)

Number of Personnel: 200 people

Number of Subsidiaries: 14 Divisions

- Petroleum Engineering
- Finance
- Planning and control of projects
- Procurement of goods and services
- Engineering and Construction
- Human Resource Management
- Legal Affairs and Contracts
- Protection
- Public relations
- Health, Safety and Environment
- Inspection of technical protection
- Research and Development
- ICT
- Systems Engineering and Productivity

Vision:

To become a fully nurtured, self-sufficient, and self-contained oil and gas technology company within NIOC

Mission:

To carry out development projects in line with Iran's values, the Company shall ensure the followings:

- Riskless and safe implementation of projects
- Following national requirements
- On time implementation of projects
- Implementation of projects within allocated budget
- Maintaining the quality and ecological balances in projects' implementation using appropriate methods
- Close examination of project implementation to prevent depletion and preserve natural resources for posterity
- Choosing the best method to meet logical requirements, projects' implementation
- Adopting appropriate approaches to implement projects following national and international standards

Values:

- Passion for excellence
- Quality cultivation as a way of life and high standards of work culture
- Innovation with value addition is an essential element to progress
- Cultivation of high standards of ethics and quality for a strong corporate identity
- Promotion of integrity and trust is a major principle to success
- Boosting harmonious and productive working ties with various contractors so that the projects are coordinated in a most cost-efficient and timely manner.

Management of Technology

Number of Personnel: 150 People

Number of Subsidiaries: 2 Divisions

- Research
- Technology

Objectives:

- Formulate plans for human resources development and developing and delivering programs and procedures for the provision of education. Also training in the research and technology interacts with the executive?
- Formulate supply and allocation plan of resource associated with knowledge creation and technology transfer as required in the oil industry including finance development plans, joint ventures, investments, development of some projects with high risk
- Develop plans and procedures for securing and allocating financial resources to research, technology and innovation in the oil industry
- Formulate plan of supply and development of infrastructure resources and develop programs and procedures that are necessary for the provision and allocation of infrastructure, technology and innovation
- Supervision and allocation of financial resources to technology within the petroleum industry "operating income" and "technology transfer fund development projects" in the main subsidiary companies

Management of Planning

Number of Personnel: 76 People

Number of Subsidiaries: 4 Divisions

- Planning and combining plans with projects
- Hydrocarbory reservoir projects
- Projects evaluation and supervision of optimisation of energy consumption
- Feasibility of studied projects

Mission:

Maximizing the value of NIOC through planning and decision making based on commercial approach, transparency, consistency, and flexibility in order to optimize business relationships based on trust and integration of planning activities and decision-making in NIOC.

Vision:

To obtain an excellent position of production and investment planning, technical and economic studies, projects, allocate resources and monitor the implementation of NIOC projects between international corporations.

Objective:

Storage capacity in the oil and gas fields that are producing and developing new oil and gas reservoirs, and fields along with the development of downstream facilities of oil and gas projects by using local resources and foreign finance through communication and coordination with other related institutions and subsidiaries.

Strategies:

- Activation of short-term and medium-term planning in order to increase the effectiveness of their practical applications in the National Oil Company and its subsidiaries
- Strategic plan for increasing oil and gas production with full capacity of internal and external opportunities, strengths and weaknesses with a view to the current and future threats.
- Updating information of demand and supply of energy carriers in the upstream oil and gas hydrocarbory reservoirs in the area.
- Prioritising and conducting investments towards programs.
- Direct research resources to preserve oil and gas reservoirs, optimize production, reduce environmental impacts, clean production, increase productivity (manpower, capital and total factor productivity), optimize energy consumption etc
- The process of planning, resource allocation, monitoring performance, preventing centralization, optimising decision-making process, reducing costs and increasing productivity.
- Maximum absorption of foreign capital for the implementation of the portfolio system for projects in National Iranian Oil Company and subsidiaries.
- Optimization of energy consumption to achieve international standards.
- Deployment of energy management systems in NIOC through implementing energy saving strategies, training and deployment of energy management units.
- Implementation of PMIS project in all subsidiaries of NIOC.
- Analysis, design and construction of integrated planning of management website and automating various activities in integrated planning.
- Design and development of Key Performance Indicators and their evaluation.
- Integration of production planning and financing capital projects and coordination in their implementation.

- The systematic process of creating, reviewing and approving projects National Iranian Oil Company.
- Trying to overcome obstacles in implementing Clean Development Mechanism Projects in the National Iranian Oil Company.
- To promote the knowledge and practice of integrated planning and management of human resources in order to achieve the vision, goals and objectives.

Manufacturing Support & Procurement Kala Naft Company

Number of Personnel: 350 People

Number of Subsidiaries: 9 Divisions

Managements:

- Specialized Services
- Manufacturing Support and Local Purchasing
- Foreign Purchasing
- Finance
- Human Resources
- Transportation & Customs Clearance

Staff offices:

- Sourcing Department
- Tender Committee
- Technical Inspection Department

Mission:

"Procurement and purchasing the goods and raw materials from local and foreign sources and supporting local manufacturers and producers of items required by oil industries in terms of financial and engineering supports as well as giving any required contribution for setting up factories for producing required materials and items by oil, gas, petrochemical and affiliated companies of ministry of petroleum as per strategy of the ministry".

Objectives:

- Purchasing upstream and downstream items.
- Procurement and purchasing the goods and raw materials.
- Transportation and customs clearance.
- Financial support of local manufacturers and producers.
- Presentation of technical services in connection with materials and equipment required by oil, gas, petrochemical and affiliated companies of ministry of petroleum.
- Mutual cooperation with original foreign companies in line with transferring technical know-how of manufacturing items to Iran.

National Iranian Oil Production Distribution Co. (NIOPDC)

Number of Personnel: 17500 People

Number of Subsidiaries: 16 divisions and 28 regional companies

Managements:

- CNG
- Operation
- Fuel smart card system
- Planning
- Finance
- Administration
- Supply and distribution
- Engineering and projects

Other divisions:

- Inside inspection
- Security
- R & D
- HSE
- Law
- Technical inspection
- Public relationship

Mission:

Supply and distribution of more than 226 million litters of different oil products throughout the country. NIOPDC utilizes the following facilities and installations to supply and distribute the oil products to different economic sectors.

Vision:

Achieving first place in the management of supply of petroleum products and become active in the petroleum markets in Middle East.

Objectives:

- Planning and outlining procedures of oil product distribution
- Management and distribution of oil products.
- Supervising the distribution operations
- Maintenance of installations related to storage and distribution of oil products.
- Installation of storage tanks for oil products.
- Implementation and supervision of smart card centre for gasoline distribution.

National Iranian Oil Refinery and Distribution Co. (NIORDC)

Number of Personnel: 86000 People

Number of Subsidiaries: 3 main subsidiary companies and 16 refineries and 10 divisions

Subsidiary companies:

- National Iranian Oil Production Distribution Co. (NIOPDC)
- National Iranian Oil Engineering and Construction Co. (NIOEC)
- Iranian Oil Pipelines and Telecommunications Co. (IOPTC)

Divisions:

- Planning

- Administration
- Finance
- R & D
- IT
- HSE
- Commercial affairs
- Coordination and supervisory of production

Mission:

- Crude oil refining
- Crude oil and product transfer
- Products distribution
- Export and import of oil products

Strategies:

- Employment of advanced technologies to boost efficiency
- Expanding Refining Capacity to give added-value to our crude oil
- Upgrade the quality of products to meet new environment requirement
- Growing presence in regional markets & collaborating with neighbouring countries
- Attracting the participation of local and foreign private sectors in refining projects
- Expanding pipeline and storage networks to meet our import/export requirements

Iran Oil Pipelines and Telecommunication Co. (IOPTC)

Number of Personnel: 850 People

Number of Subsidiaries: 15 Divisions

- Pipelines
- Telecommunication
- Projects and engineering
- Planning
- Administration
- Logistics
- Commodity services
- Financial
- R & D
- Laws & contracts
- Technical inspection
- HSE
- Public relationship
- Internal inspection
- Contract commission

Mission:

Maintenance and sustainable, safe and economical exploitation of pipeline and transferring petroleum through support of industrial telecommunications network with %99.99-confidence coefficient.

Vision:

To achieve top rank in major transition, stability and safety on crude oil and petroleum products, and in providing industrial services in the Middle East.

Objectives:

- Safe transmission of crude oil from the origins to the seven major refineries
- To receive petroleum products (including gasoline, kerosene, gas oil, fuel oil and jet fuel) from refineries to storage tanks connected to the pipelines across the country.
- To supply liquid fuel of the power plants, airports and the feed of some petrochemical industries
- To control the transportation network with over 123 million litters of oil products annually by 14000 kilometres of pipelines and 264 telecommunication stations

Strategies:

- To implement projects of sustainable transmission and safe pipelines, including: replacing worn-out and old pipelines with new pipelines, redirecting and immunizing route of pipelines in urban areas, etc.
- To develop transfer pipelines of oil products in accordance with increasing the capacity of the refineries and National Iranian Oil products Distribution Co.

NIGC (National Iranian Gas Company): Natural gas has a number of functions including its function as a source of heat. Natural gas is extremely beneficial for the economy and it is capable of being transformed into numerous valuable merchandises in the petroleum and petrochemicals industry (NIGC History, 2012). The increasing demand for gas as a source of fuel and energy , and the foreign exchange occasioned from sales and export for investment and initiating infrastructural businesses in Iran, secured the notion of pushing gas industry associated activities. Accordingly, and as provided by national legislation, NIGC was developed as one of Iran's Petroleum Ministry's four main subsidiaries. The company's start-off capital came to RLS 25 billion, in 1965. From the time when it was set up, NIGC has progressively attained competences and gained access to several different facilities and sources like specialists and well-organised staff armed with technical and academic information; machinery, tools, equipment and numerous cutting-edge workspaces for applying its processes proportional to the Iran's economic and social growth style. Gas is one of the biggest energy sources and NIGC profited substantially from it. Currently, NIGC is conducting its duties in accordance with internationally recognised requirements. At the moment NIGC is among the top ten gas companies in the Middle East's gas industry in the, and it is also among the Petroleum Ministry's the four main holdings. NIGC has been in business for more than 45 years and has provided more than 61% of the Iran's fuel. With respect to the provision of gas, NIGC plays a crucial role locally as well as internationally. Accordingly and in proportion with its requirements and the local and international developments the company has taken steps to improve its structure. NIGC has hired specialists and conducted staff training, whilst preserving and strengthening its knowledge in relation to both hardware and software. Presently, the NIGC employs 18000 permanent staff members and more than 18000 contractors (NIGC History, 2012).

A brief profile of the subsidiaries which have been selected for NIGC are explained in the following tables.

Management of HSE (Health, Safety and Environment)

Number of Personnel: 15 persons

Number of Subsidiaries: 4 Divisions

- Health
- Safety
- Environment
- Crisis management and defend passive

Mission:

To establish a safe environment in which all potential hazards are eliminated in order to protect health of its employees, contractors, consultants, visitors, neighbours, suppliers and clients. Furthermore maintain the national resources and environment (need to give more information) . Thus establishing, developing and continuously improve the HSE management system, all National Iranian Gas Company directors, supervisors and other staff members are accountable to extend their efforts with unanimity agreement and cooperation in realising these objectives.

Vision:

Moving towards sustainable development, increased productivity and human resources quality advancement by current standards

Objectives:

- Prioritise health & safety and environmental issues in Iranian National Gas Company
- Provide a new insight and an open and constructive intra-organisational (between directors and staff) and extra-organisational (between NIGC and interested parties) communication system. Also setup easily accessible statistics and information
- Allocating required financial assets aimed at human and organisational resources for individual health & safety as well as environmental
- Complying with both Iran's national Petroleum Ministry rules, regulations and standards, as well as International laws
- Optimisation of energy use and resources thus minimising wastes and pollutants
- Assessing and reviewing the methods and programs in health & safety and environmental (HSE) management system in order to achieve continuous improvements
- Providing and maintaining the required training
- Identifying, assessing, eliminating and/or controlling effectively the potential hazards under normal, changing and critical conditions
- Supporting research, investigations and technology
- Identifying and utilising skilled and committed people
- Encouraging and paying tribute to those who have had an effective role in the development and improvement of HSE management system

Management of HR (Human Resource)

Number of Personnel: 350 persons

Number of Subsidiaries: 2 Deputies

Deputy procurement and human resource development:

- Human resource planning
- Human resource training and equipment
- Administrative productivity and reform
- Supply of human resources
- Human resources research and development

Deputy of administrative affairs:

- Sport and physical education
- Employment affairs
- Administrative services and welfare
- Contract services and contractors
- Social work and industrial relationship
- Information management system
- Plans, methods and administrative regulations

Mission:

Human resource development and strategic approach to attracting, developing, managing and motivating key resource or organisation that deals with personnel. In order to achieve the objectives, the following tasks and strategies and desired outcomes of the collective efforts of staff, organisational chart opposite functional areas in management and human resource development are shown in.

Objectives:

- Supply of manpower
- Empowerment and effectiveness in achieving creativity in manpower
- Nurture and develop the talents and skills of people
- Maintaining good relations between them and competent personnel
- Providing material and spiritual needs of staff satisfaction and reduce employee concerns and resolve concerns so that the alignment between their personal goals and objectives of the organisation to be created.

Strategies:

- Designing a knowledge management
- Educational Standards
- Standardising Services and Quality Management
- Institutionalizing recommendation system
- Development of sport among employees and their families
- Implementation of organisational processes with customer-oriented approach

Division of HR Training

Number of Personnel: 30 People

Number of Subsidiaries: 5 Divisions

Divisions:

- Management training
- Engineering training
- Apprentices services
- Administrative, financial and business training
- Evaluation and planning

Mission:

To establish a safe environment in which all potential hazards are eliminated in order to protect health of its employees, contractors, consultants, visitors, neighbours, suppliers and clients and maintain the national resources and environment. To establish, develop and continuously improve the HSE management system, all National Iranian Gas Company directors, supervisors and other staff members are accountable to extend their efforts with unanimity agreement and cooperation in realising these objectives.

Objectives:

- Conduct and supervision of apprentices, student scholarships abroad, internship, student internship and other activities that are related to the field of administrative services
- Provide critical projects, educational policies, conduct, control and supervision of all educational activities, research, technical for professional positions
- Promotion and sustainable development of knowledge management through designing and developing a new system of training, management development and determination of organisational goals and task planning
- Design and develop training programs based on positions of administrative, financial, commercial, and legal contracts
- Developing a systematic approach to design, implementation and evaluation of learning and teaching process in accordance with the purpose of using scientific findings and research by applying human and inhuman factors in order to create effective and sustainable organisational learning

Management of International and Commercial affairs

Number of Personnel: 23 People

Number of Subsidiaries: 4 Divisions

- Regulations, procedures and treaty business
- Develop methods and coordination of treaty regulations
- Resources and research of business and contractors
- Self-sufficiency in commodity

Objectives:

- Develop control and supervision systems in commercial systems and supervisory in implementation of commercial systems in subsidiaries of NIGC
- Improve the quality of work units on methods and systems for commercial and treaty provisions
- Identify frequently used items and prioritise them for planning to build them in the inside of the country
- Preparation and collection of technical specifications, drawings (blue prints), standards, production methods of machinery components and materials which are required for administrative units of NIGC and its subsidiaries
- Implementation of Integrated Information System in order to prevent the development of different systems and to maintain uniformity across systems

Division of KM (Knowledge Management)

Number of Personnel: 7 People

Number of Subsidiaries: 2 Divisions

- Studies and projects
- Research and development

Objectives:

- Develop knowledge tree of NIGC with nearly 375 knowledge branches in subsidiary companies
- Documentation of 200 experiences
- Access to a vast bank of knowledge in the fields of management and technical knowledge
- The installation and placement of web-based application with the ability to retrieve, evaluate and enrich the knowledge
- Study of "how to" documents of the experts' experience within the oil industry
- Provide experts' knowledge handbooks
- A computer knowledge database which is extracted with a variety of classification and retrieval (collectively)

Management of R & D (Research & Development)

Number of Personnel: 60 people

Number of Subsidiaries: 7 Divisions

- Standards codifications
- Research, development and technology
- Relationships with science centres
- Industrial and technical labs
- Planning and projects controls
- Information and statistic centre
- Technology and policies

Mission:

Policing and conducting R & D division of the subsidiaries and operational areas in a large-scale

Objectives:

- Institutionalization of research as a means for developing the gas industry
- Compilation of objectives, policies and strategic programs of research and technology in the gas industry
- Evaluation of new technologies for the development of strategies to achieve the quality and quantity of research activities
- Supervisory actions on formation of research system and activities of the subsidiary companies
- Serious interaction with universities and research centres in order to achieve the set objectives

- Development of specific information tools in the gas industry

Management of Structure

Number of Personnel: 23 People

Number of Subsidiaries: 3 Divisions

- Industrial engineering
- Classification and evaluation of jobs
- Management information system

Mission:

Transferring organisational strategies to organisation structure

Management of Coordination & Supervisory of Production

Number of Personnel: 5000 People

Number of Subsidiaries: 3 Divisions and 12 Refineries

- Coordination and production control
- Production engineering affairs
- Supervision and commissioning of Engineering and Plan

Mission:

Regulating a better refinement operation and gas production, with production continuation turn, productivity increase and reduction in production costs.

Vision:

The role National Iranian Gas Company as the centrepiece of the development, production, management, coordination and supervision of gas production is fundamental. In order to better organize gas production, refining operations, the approach to sustainable production, increase productivity and reduce production costs.

Objective:

The management, coordination and control in three areas of production, the production engineering, implementation and monitoring of project activities commissioning supervision is gas refining companies.

Management of Dispatching

Number of Personnel: 50 persons

Number of Subsidiaries: 3 Divisions

- Deputy of operation (Dispatching Control Centre and gas quality control and measurement)
- Affair of studies, planning and systems analysis
- Technical Logistic Affair

Mission:

- Control and supervision of production, transmission, distribution, export and import of gas.
- The NIGC manages the operation of the gas supply network with more than 150 billion cubic meters of annual production, the world's fourth largest producer of gas. With 33,000 km of high pressure pipelines and a large number of Clients within the public sector as well as private commercial companies.
- The NIGC dispatching teams' main duties include the coordination between various production departments for transmission, distribution, quality measurements and supervision of various processes involved.

Dispatching National Iranian Gas Company Management responsibilities
which includes the management of activities in four sections the generation, transmission, distribution, import and export:

Production

- Coordination with upstream
- Production Planning
- Planning Overhaul gas refineries
- Measuring and controlling the quality and quantity of gas delivered

Transfer

- Operations Control Station
- Control of gas transport routes
- Optimization and maximum use of natural gas transmission facilities (reducing energy consumption)
- Planning Overhaul stations and transmission lines
- Operations Coordination pig racing and Hot-Tap (getting split g)

Distribution

- Control the quantity and quality of gas delivered to consumers
- Planning and Cost Control
- Input power stations and urban planning repairs imports and exports
- Monitoring and controlling agreements, import and export operations

At present, they management only three main parts:

- Department of Operations (National Gas Control Centre Dispatching, units of measure and control gas quality)
- Department of Planning and Analysis System
- Matters Technical Support

Management of Distribution

Number of Personnel: 38000 People

Number of Subsidiaries: 3 Divisions and 31 provisional gas companies

Divisions:

- Tariffs and controls
- Planning
- Gas distribution to main industries and power plants
- Investigations affairs
- Technology and engineering affairs
- Exploitation affairs

Mission:

- Distribution and selling gas through 31 provincial gas companies and coordination and management of them with NIGC's strategies and policies
- The management, coordination and control in three areas of production, the production engineering, implementation and monitoring of project activities commissioning supervision is gas refining companies.

Coordination and control of manufacturing: The responsibilities for these matters be referred to the following major items:

- Data collection and statistics on the quality and quantity of food intake, the exhaust gas purification, fuel and chemicals, and waste gas refining companies in order to record and process information in complex networks and prepare analytical reports and statistics.
- Coordination and monitoring of trade between the quantity of feed intake and feed gas refining companies
- Continuous monitoring of production parameters on the process and identify the causes of nonconforming product
- Investigation and participate in preparing production plans
- Necessary to promote efficiency indicators to assess gas refining companies.

Production Engineering Department: The responsibilities for these matters can be referred to the following major items:

- Continuous monitoring of the quality of the produced gas refining companies and develop engineering guidelines for improving quality and productivity.
- Studying for the maximum use of capacity and gas refining companies
- Pathology of technical difficulties stemming operation (RCA) in order to maintain sustainable production
- Coordination and monitoring plans, annual overhauls gas refining companies.

Supervision and commissioning of Engineering and Design: This includes the following activities:

- Supervision of EPC projects from feasibility stage to project implementation and delivery
- Coordination and monitoring of plans to create a database of license holders and international

consultants
- Supervising the preparation of technical documents, selecting consultants and contractors associated with the project
- Extracting energy management plans, modification and upgrade domestic consumption
- Identify new technologies and context of use in the design and production

Iranian Gas Engineering and Development Co.

Number of Personnel: 4500 persons

Number of Subsidiaries: 5 Divisions

- HR
- Financial
- Construction and engineering
- Logistics and commodity services
- Planning and project control

Mission:

Project management and successful execution of gas conveyed from the National Iranian Gas Company (successful execution: run-time, cost and quality approved)

Vision:

- Being introduced as a leading company in the management and implementation of projects and gas industry (Pipelines, pressure boosting stations, refineries and related structures)
- In the Middle East and earned third place in the world (in order to devote at least 10% share of global gas trade)

Quantitative targets by the end of 1403 (Outlook 20):

- Management and implementation of projects identified in the gas industry (including pipelines, compression stations, refineries and related structures) to provide energy for
- At least 95% of urban areas
- 40% of rural households
- All the plants
- All the energy industry
- All gas-powered vehicles

Quantitative targets:

- Management and implementation of the necessary infrastructure (pipelines, compression stations, refineries and related structures) to produce 900 million cubic meters of natural gas daily distribution with emphasis on energy-intensive industries due to the consumption of at least 100 million cubic meters day
- Design and Construction of 500/12 kilometre gas pipeline
- Design and construction of 35 gas boosting stations (reaching 2500 MW capacity)
- Design and construction of new refineries and the expansion of existing refineries to achieve refining capacity of 586 million cubic meters of natural gas per day and Dehydration
- Design and maintenance of 10 (yard maintenance)

Iranian Gas Transmission Co.

Number of Personnel: 7000 People

Number of Subsidiaries: 17 Divisions and 10 Operational companies

Managements:

- HR
- Financial
- Projects and engineering
- Logistics and commodity services
- Planning
- Operation coordination
- Telemetry and telecommunication

Divisions:

- R & D
- Low
- HSE
- Security
- Public relationship

Mission:

Optimum transmission of gas through 10 operational companies and their coordination and supervision by using the NIGC's strategies and policies.

Objectives:

- Taking over natural gas from external and internal production resources and transferring it to determined points (internal and external)
- Exploitation, maintenance and repairing of gas transmission pipelines
- Supplying the communication networks for making an operational connection between pipelines and gas pressure increase or decrease stations.

Management of Planning

Number of Personnel: 60 People

Number of Subsidiaries: 3 Divisions

- Department of Planning and Evaluation
- Department of Economic Studies and Engineering Projects
- Department of Management Information Systems

Mission:

- Identification of main objectives and strategies for NIGC
- Estimation of natural gas consumption rate
- Forecast of the required installations for refine, transmission, storage and distribution of gas
- Budget allocation for operational projects
- Evaluation and supervision on the projects implementations

The main duties of the vice president for planning and evaluation include:

- Develop strategies for planning the National Iranian Gas Company
- Formulation of quantitative and qualitative goals of the company in the form of short term, medium term and long term
- Refinery's program formulation, transmission and distribution of natural gas
- Feasibility study of gas
- Preparing a five-year program
- Estimates of financial resources and revenues
- Prepare budgets and capital flows now
- Monitoring the current progress of projects

Vice president of engineering and economic studies department are composed of the following units:

- Office of Energy Management and Studies
- The engineering studies
- State Economic studies
- Evaluation of the sources and uses of gas

The main duties of the vice president of engineering and economic studies include:

- Technical studies in the field of design, construction and operation of the National Gas Company of New Facility
- Provide technical reports and feasibility of project company
- Provide review and uses the resources of gas
- Estimated operating costs and investment company, plans
- Plan refining, pipelines, storage and distribution of natural gas
- The estimated annual import and export natural gas
- The estimated amount of gas products, such as Ethane, Sulfur
- Gathering information to prepare energy balance
- Analyse the performance of energy management at the corporate level

Data Analysis

The design of qualitative research is circular in nature. It is important for qualitative researchers to adapt and revise their designs in order to match the research flow. Once researchers have chosen their methods and compiled their data they must analyse the results. Results can be analysed in a variety of ways; for instance findings can be interpreted by connecting the data to a broader sociological context and creating ideas (Bryman, 2004). Moreover, results can also be evaluated by finding the data's patterns and trends. It is possible to do this by making use of textual analysis like applying computer software like Nvivo.

The collected data from the interviews must be categorised, interpreted and explained in accordance with the research questions. The tool of data analysis was chosen to be the Nvivo software for this research. Nvivo is a qualitative research application for analysing the data acquired from the interviews (Srivastava and Thomson, 2009). After collecting the required

data, they are entered into Nvivo application. Nvivo is software for doing the qualitative research and it can sort and analyse data. Finally, data is interpreted and analysed and then an appropriate KBO is designed for the oil and gas industry. The validity model is also important. In order to be successful in achieving this goal, the designed model was assessed by some experts and mangers in this field.

Ethical Issues

After finalising and designing the questionnaire, the Research Administration Office of Management School should be reviewed the designed questionnaire and approve it ethically. Consequently, Ethical Approval forms were filled and sent to the Research Administration Office and they approved it.

Also, some permits were required in order for us to interview the managers and experts in the NIOC and NIGC. They have strict regulations for people who intend to conduct interviews in their organisations. Since I have worked in their organisations for many years, therefore, they issued the relevant permits for collecting the required data.

CHAPTER 5: DATA ANALYSIS AND DISCUSSION

Introduction

The collected data was categorised, interpreted and explained with accordance to the research questions in this chapter. As discussed, the data and method of the research was qualitative; therefore, the research data analysis was also qualitative. A number of methods and practices are involved in qualitative data analysis. These methods and practices assist researchers to interpret and attach meaning to the collected data (Lewins et al., 2005). In most cases interpretative philosophy forms the basis of qualitative data analysis.

Approaches of Qualitative Data Analysis:

In general, as figures are not involved, qualitative researchers aim to identify themes or categories in the collected data in order to define and clarify phenomena (Pope et al., 2000). Researchers evaluate the patterns and relationships between the recognised themes or categories that have been. There are two approaches that can be used to identify these themes or categories (Elo and Kyngas, 2008):

Inductive

In terms of this approach the themes or categories are given the chance to slowly reveal themselves in the data. The inductive approach is used when the inquiry's major design is qualitative research. In this case the developing context the data is assembled and the researcher attempts to identify connections between the categories of data.

Deductive

In terms of this approach, the researchers pinpoint the themes or categories and incorporate the data into the themes or categories at the beginning or in the middle. The deductive approach is applied once the research questions have been formed to classify the data and then search for connections. This approach is used when there are restrictions on time and resources and the qualitative research is a less significant element of a bigger quantitative research.

According to the above mentioned information, the research approach is inductive, because this research does not intend to make comparisons, while the research wants to study different components of KM and e-business and others. Therefore, it should be investigated about

knowledge-based organisation and e-enabled knowledge network. Therefore, the research approach is inductive.

Stages of the Research Data Analysis

Figure 5-1 demonstrates the stages of qualitative data analysis (Lacey and Luff, 2001). The stages are including familiarisation to the data, transcription, organisation, coding, analysis, interpretation and reporting.
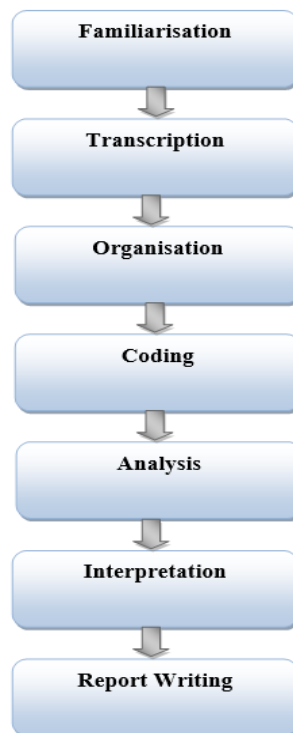
Figure 5-1: Stages in the research data analysis (Lacey and Luff, 2001)

Familiarisation

This is stage one in the process of data analysis. A great deal of material is involved in data analysis and researchers may have to play recorded voices and review video material, read and re-read field notes, write up memos and outlines prior to the formal analysis (Rabiee, 2004). This is particularly significant when researchers are also taking part in collecting the data. Researchers have to be acquainted with the field notes. In this study, the researcher played recorded voices of the experts in the interviews, re-read notes and wrote up memo of the expert panels, the interview meetings and documents of the secondary data.

Transcription

Transcription involves adapting audio-recorded data or handwritten field notes taken from interviews and observations into words (in other words. written or printed) in order to ensure simple reading (Grbich, 2012). The fact that researchers may focus on parts of the audio recording or field notes that they find interesting if they are not in written form makes transcription extremely important. Transcription of the data gives the research an overall picture and reduces the likelihood of bias on their part. In this study, the researcher has transcribed the data twice. First time, all the data was transcribed to Persian. Then, the data was translated to English.

Organisation

Data must be organised after transcription in order to make retrieving it easier. In this study, the data was organised by Nvivo.

Coding

This involves reviewing the raw qualitative data in the transcripts and removing segments of text units (words, phrases, sentences or paragraphs) and allocating various codes or markers in order for them to be extracted without difficulty later on for more assessment and scrutiny, as well as the identification of any themes (Auerbach and Silverstein, 2003). Subjects, themes, concepts, perceptions, expressions, sayings and keywords in the data can form the foundation of Codes.

The underlying idea or concept is expressed in the name given to the theme or category. A suitable label is given to all the parts of the data that deal with a code topic. Coding is comprised of reading the text carefully (connecting labels through the text, images etc.) or carefully evaluating the video or images. New codes are created when data does not fit in the existing codes. The number of codes develops as additional subjects or topics emerge as the researcher goes through the data. In this study, all the data were coded by Nvivo.

Analysis

Nvivo software is data analysis tool for this study. Nvivo enables the researcher to consolidate and examine non-numerical or unstructured data (Auld et al., 2007). It lets the researcher categorise, class and organise material; scrutinize relations in the data; as well as combine analysis and linking, modelling, searching and modelling. Nvivo is a software and qualitative

research method used for analysing the data acquired from the interviews (Bandara, 2006). The reasons for using Nvivo in this research are as follows (QSR Nvivo10, 2013):

- Devote more time to discovery and analysis, as opposed to administrative tasks

- Labor methodically while ensuring not to omit anything in the data

- Question the data and reveal delicate relations in ways that are not manually possible

- Meticulously rationalize the findings with the evidence

- Manage all the material in a single project file

- Fluently share the work with other people

Interpretation

This is the process of recognizing and discussing the principal significance of the data, systematising and linking developing contradiction and themes in order to obtain an overall view of the data, finding a suitable way to incorporate the data from various sources and methods, finding answers to social and theoretical questions and ensuring trustworthy and credible analysis (Hernandez, 2013).

Report Writing

The analysis of qualitative data can be difficult. If carried out appropriately it is methodical and laborious, and consequently both labour-intensive and time-consuming (Burnard et al., 2008). The main component of qualitative analysis is finding, building, clarifying, illustrating and explaining an issue or argument. The analysis must adopt the structure of a research essay comprising specific anticipated components: researchers must present them and structure the components in a rational manner. A good adequate research report explains and convinces. Clear writing is a requirement of persuasiveness. Writing should enable readers to be able to make sense of the data. The proof is the collected data from which researchers cautiously select extracts to prove pints in their reports. In order to effectively display what the researchers are trying to prove the data must be correct and adequate. Furthermore, the applicable evidence should be obtainable in a portrayal that exhibits the point being made in narrative form. Good qualitative analysis explains a worthy, understandable and absorbing story (Campbell et al.,

2006). This story is understandable because researchers have communicated the research to their readers.

Analysis of the Research Data with Nvivo

Using Nvivo has many advantages which help researchers to analyse the collected data. Here are some key advantages:

- Rapidly produce coding by means of auto-coding or queries

- Identify themes in data through queries

- Coding and query data

- Single project file that can be effortlessly transferred and shared with other people

- The capacity to annotate, link, and generate relations

- The capacity to make models that are connected to the items

- Reorganise and reshape coding and structure of node easily and rapidly

Therefore, the researcher decided to use Nvivo for analysing the collected data. The researcher carried out the following steps to analyse the data through Nvivo:

Importing Data

The interview transcriptions were in Persian language; therefore, they had to be translated into English. Then, all the transcriptions of the interviews and other documents of the secondary data were imported in Nvivo. Figure 5-2 illustrates the subsidiaries of NIGC which were coded with the letter "G" 1-14 and also NIOC's subsidiaries are "O" 1-17. Each subsidiary (G or O) has its relevant data which was derived from the interviews and the secondary data.

Figure 5-2: The collected data of the subsidiaries of NIOG and NIOC, which were imported in Nvivo

Creating Nodes

A node is created for every theme, concept, idea or category of the data. Nodes are fundamental to understand and work with Nvivo. They enable the researcher to collect connected material in a single location in order for the researcher to identify idea and emerging patterns. Thus, the researcher generated and systematised nodes for organisations. The nodes (as shown in figure 5-3) were identified based on the models (KBO, e-business and research), the core questions, propositions of the research and the key components, which are also essential for the research questionnaire.

Figure 5-3: The Nodes, which were identified in Nvivo

Coding Data

Coding has a key role in the majority of qualitative projects. It comprises collecting all the information regarding a specific case or theme into a node for more investigation. The process of coding creates idea and aids to recognise theories and patterns in research material. In this study, the imported data were coded in this step. As figure 5-4 shows, the collected data of G10 was coded based on the identified nodes.
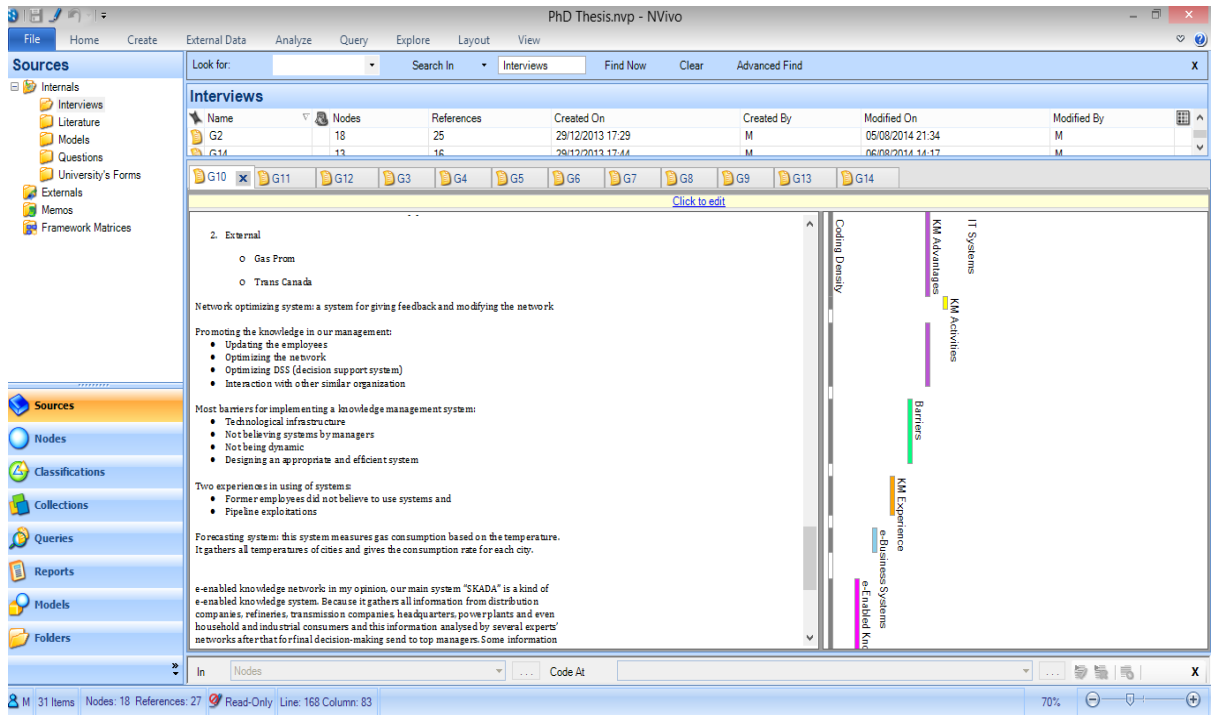
Figure 5-4: An example of coded data based on the nodes in Nvivo

The Relationships between the Nodes

Relationships record statements or hunches that a researcher has developed about how items in the research are connected. Researchers create relationships to show how research participants are related. Researchers can code content at the individual nodes and at the relationship. To record relationships between research items, first the researcher needs to create a relationship that connects them. When adding a relationship type, researchers define one of the directions: one-way, associative and symmetrical (two ways).

The relationships between nodes of this research were identified based on the models, the literature and conceptual framework of the research. Some of the relationships between the nodes have been demonstrated in figure 5-5.

Figure 5-5: Some relationships between the Nodes in Nvivo

Visualise Models

When the node and their relationships were identified, the models of the research were designed by Nvivo. The following figure (5-6) is an example of the designed models (Appendix 4), it demonstrates the components of the e-business model and their relationships based on the identified nodes.
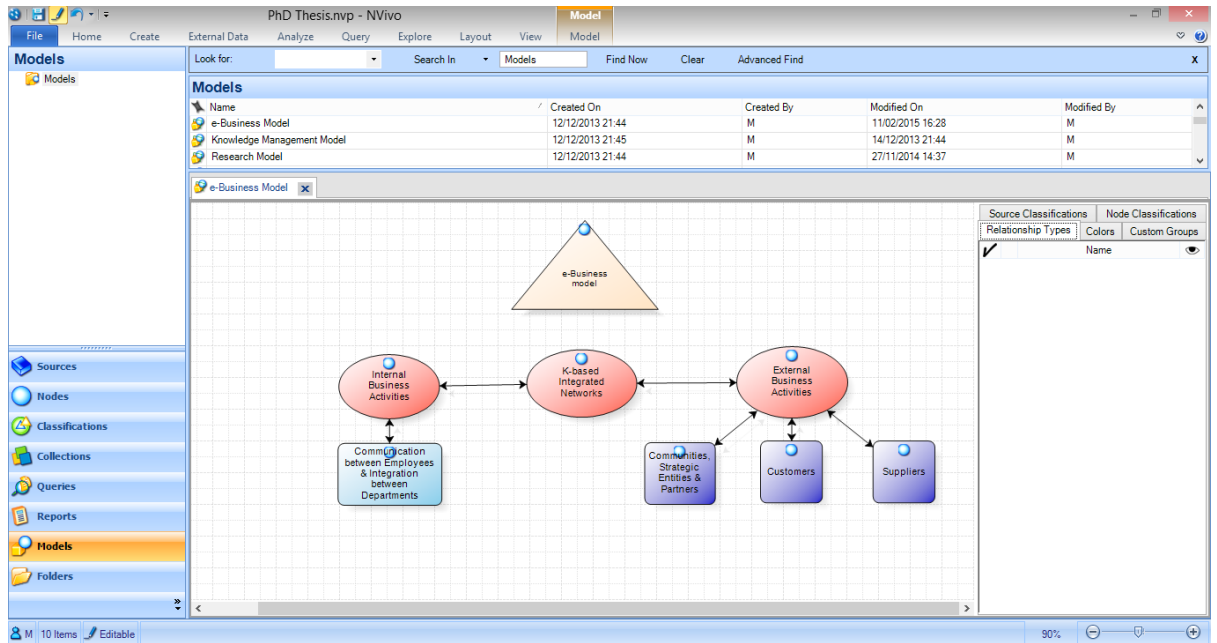
Figure 5-6: e-Business model that were designed by Nvivo

Generating Reports

Reports contain information about research that the researcher views and prints. The results of this research were derived from the Nvivo reports. The below figure (5-7) is an example of these reports.

Figure 5-7: An example of reports, which were generated by Nvivo

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An Nvivo Roadmap to Answer the Main Questions

All the companies' data was imported in Nvivo and the nodes and code of the imported data were made. Coding and making nodes are the key steps of data entry in Nvivo, because if they are done properly, the researcher can analyse and interpret the data in the next step. Nvivo generates different reports, which can deviate from the research and confuse the researcher. Therefore, Nvivo designed a roadmap. It shows how to answer the interview questions thus responding to the main questions of the research project. Figure 4-8 is a general schematic of the roadmap that has been formed based on the research process and figures 5-9, 5-10, 5-11, 5-12 and 5-13 demonstrate the relationship between the components of the roadmap.
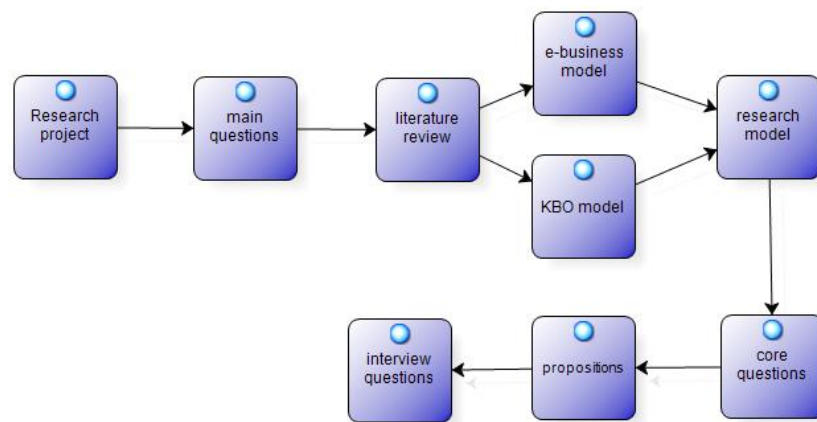
Figure 5-8: General schematic of the roadmap of Nvivo for answering the main research questions

As mentioned previously, the propositions and the core questions were derived from the research model (the research model was developed from e-business and KBO models and the literature). The interview questions were designed based on the propositions. On the other hand, all the collected data was from the interviews and the secondary data. Thus, Nvivo can make relationships between the collected data and the research process once they have been coded. Therefore, the main research questions, the propositions and the core questions were coded. The allocated codes include M for the main research questions, R for the core questions, P for the propositions and A, B, C and D for the interview questions. The codes help to categorise the collected data and to facilitate analysing them when the best answers should be achieved for the main research questions.

After coding, the relationships between them were identified. Nodes help to make connections between codes in Nvivo. Figure 5-9 shows how the research project has two main questions

(M1 and M2). The figure demonstrates the responses to the first and the second core questions (R1 and R2), which can then answer the first main research question (M1). On the other hand, the second main research question (M2) will be answered by the responses of the third and fourth core questions (R3 and R4).
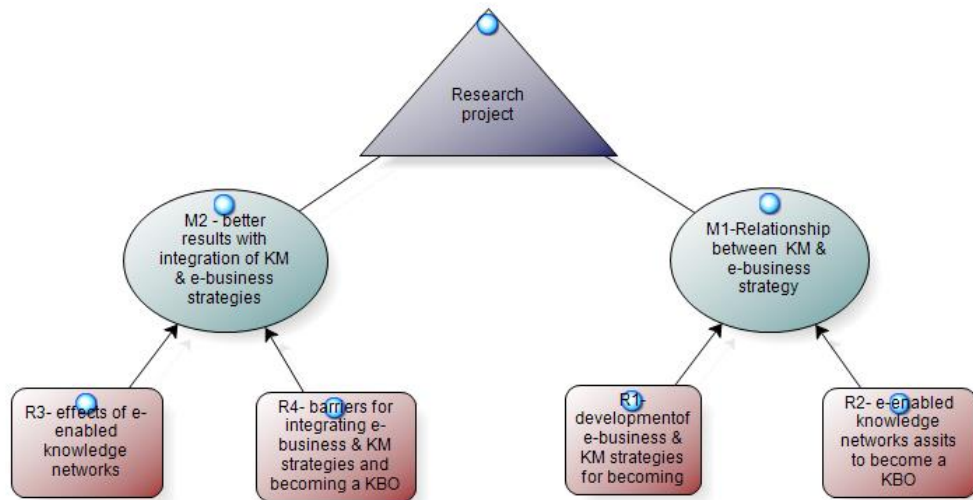
Figure 5-9: The relationships between the main research questions and the core questions

Figure 5-10 explains that the first core question, (R1) will be replied when the first, second and third propositions (P1, P2 and P3) are answered by the interviewees who will answer (A1, A2, B1, B2, C1, and C2) the designed questionnaire. As the figure demonstrates, A1, A2, B1, B2, C1 and C2 have sub-questions, which clarify the answers of the interviewees.
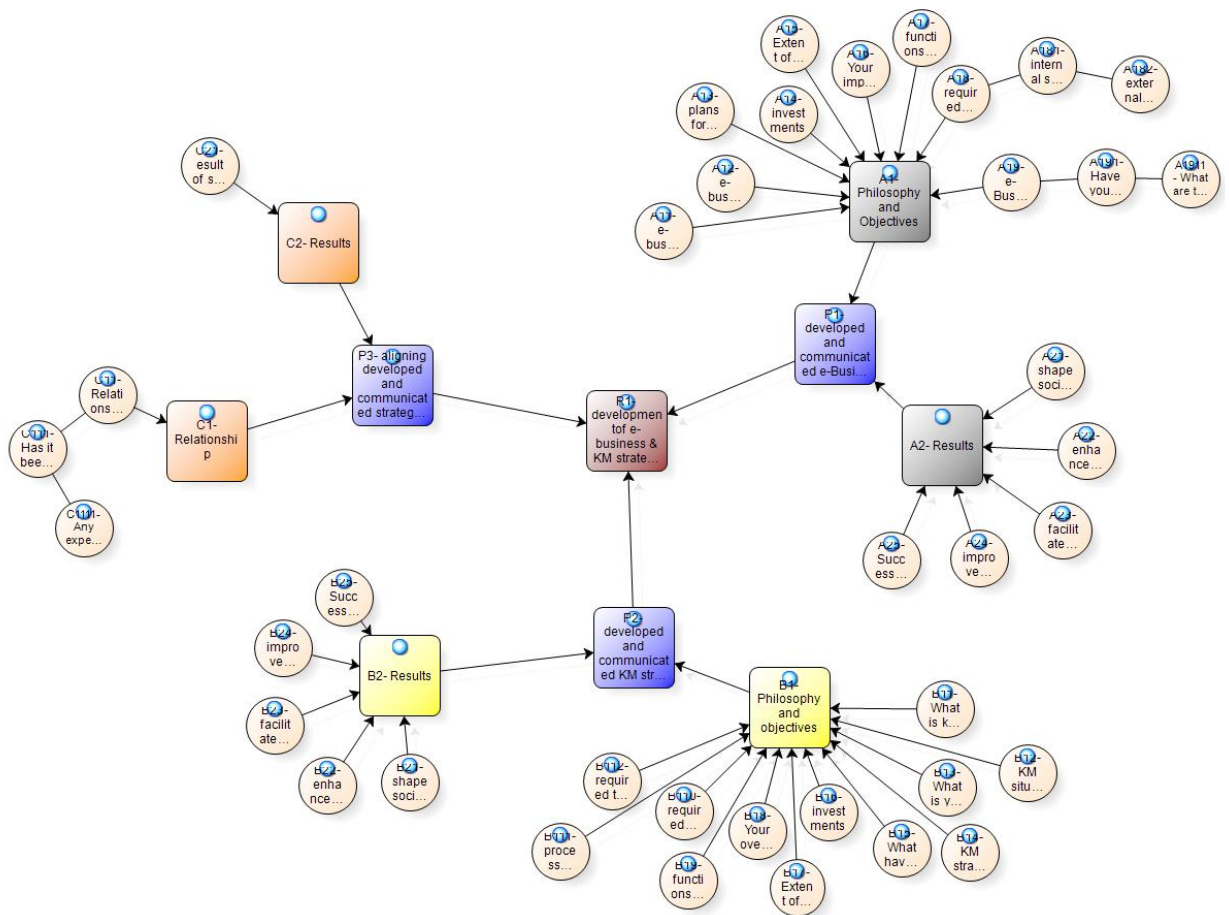
Figure 5-10: The relationships between the first core question (R1), the first, second and third propositions (P1, P2 and P3) and the interview questions (A1, A2, B1, B2, C1 and C2)

Figure 5-11 states the fourth proposition (P4) answers to the second core question (R2) while the interview questions of D1, D2 and D3 reply the fourth proposition (P4). Also, figure 5-12 and figure 5-13 demonstrate how the core questions would be answered through the research propositions and the interview questions.
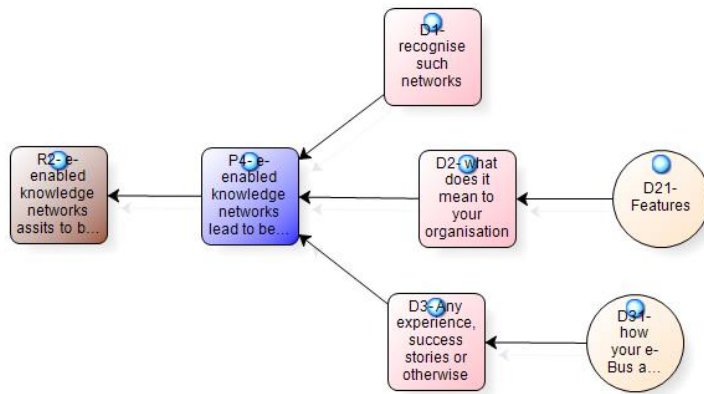
Figure 5-11: The relationships between the second core question (R2), the fourth proposition (P4) and the interview questions (D1, D2 and D3)
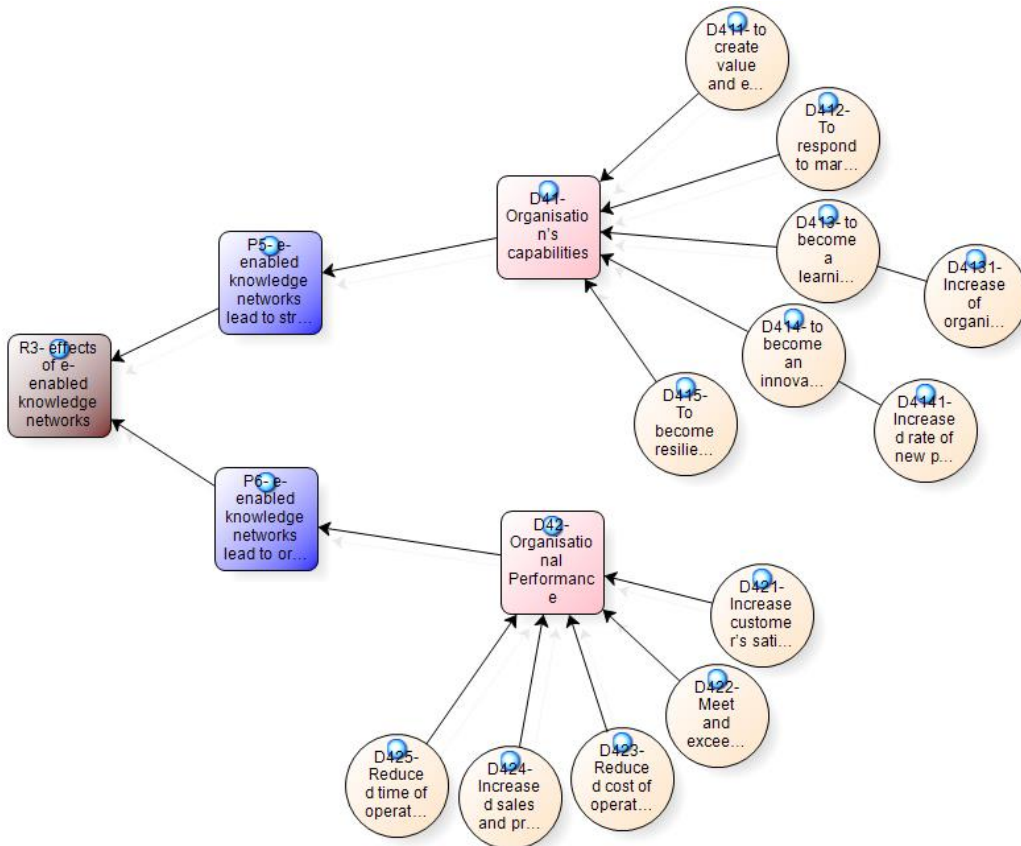
Figure 5-12: The relationships between the third core question (R1), the fifth and sixth propositions (P5 and P6) and the interview questions (D41 and D42)
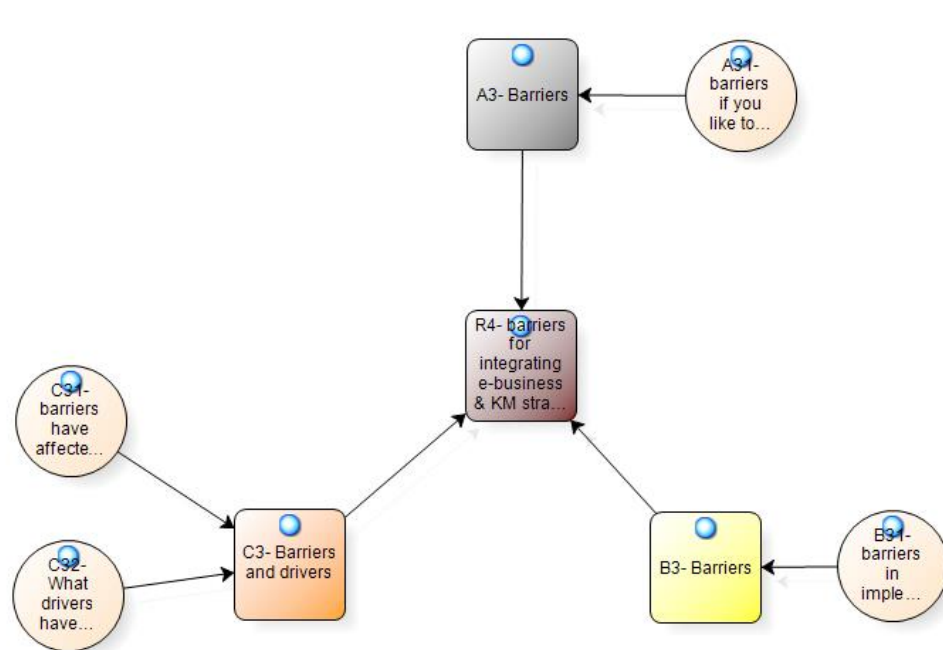
Figure 5-13: The relationships between the second core question (R1), the fourth proposition (P4) and the interview questions (D1, D2 and D3)

The subsidiaries were coded, table 5-1 contains the allocated codes to NIOC's SBUs and subsidiaries and table 5-2 is the allocated codes to NIGC's SBUs and subsidiaries.

Code	Subsidiary / SBU	Code	Subsidiary / SBU
O1	Management of Export and international Affairs	O10	Pars oil and Gas Co.
O2	Management of HSE (Health, Safety and Environment)	O11	Petroleum Engineering & Development Company (PEDEC)
O3	Management of Human Resource (HR)	O12	Management of Technology
O4	Institute for International Energy Studies (IIES)	O13	Management of Planning
O5	Division of KM (Knowledge Management)	O14	Manufacturing Support & Procurement Kala Naft Company
O6	Management of R&D (Research & Development)	O15	National Iranian Oil Production Distribution Co. (NIOPDC)
O7	Research Institute of Petroleum Industry (RIPI)	O16	National Iranian Oil Refinery and Distribution Co. (NIORDC)
O8	Management of Structure	O17	Iran Oil Pipelines and Telecommunication Co. (IOPTC)
O9	Management of Exploration		

Table 5-1: The allocated codes to the NIOC subsidiaries

Code	Subsidiary / SBU	Code	Subsidiary / SBU
G1	Management of HSE (Health, Safety and Environment)	G8	Management of Structure
G2	Management of HR (Human Resource)	G9	Management of Coordination & Supervisory of Production
G3	Division of HR Training	G10	Management of Dispatching
G4	Management of International and Commercial affairs	G11	Management of Distribution
G5	Division of KM (Knowledge Management	G12	Iranian Gas Engineering and Development Co.
G6	Management of Law Affairs	G13	Iranian Gas Transmission Co.
G7	Management of R & D (Research & Development)	G14	Management of Planning

Table 5-2: the allocated codes to the NIGC subsidiaries

Discussion of Propositions

This part discusses the results and implications which have derived from the reports and the outputs of Nvivo. The propositions of the research are discussed in this chapter in accordance with the designed roadmap of Nvivo.

Proposition 1: Clearly developed and communicated strategy for e-Business will lead to development of integrated networks which facilitate communication and flow of knowledge within the organisation and with its external environment.

Discussion: The e-Business strategies, which are clear in the organisation, have been developed via technology and have been communicated by the experts of the organisation, have been studied in this proposition. First, the results of different parts of the proposition are discussed and then the researcher summarises the results in the conclusion.

As demonstrated in Table 5-3, the definitions show that e-business has different concepts in NIOC and NIGC. Almost all of the experts defined it as "selling and buy via internet" when they were asked their definition of e-business?" Therefore, the researcher explained the definition of e-business in the research in order to establish a single concept between them. After that they could discuss the e-business systems in their organisations with respect to the research's aims and objectives.

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Company/ SBU	Definition	Company/ SBU	Definition
G1	e-trading, it means selling and buying by internet	G2	to do all activities through internet
G3	response to demands by internet	G4	when commodities or services sold by internet
G5	to carry out all activities by internet	G6	e-trading such as Amazon, e-bay
G7	e-banking; it means we can do all financial activities by internet	G8	to satisfy our needs by internet
G9	transferring information by internet	G10	e- banking or e-trading
G11	using the website (internet) by customers to carry out tasks and removing the need for face to face interaction	G12	interaction with markets of services and commodities through web
G13	buying and selling commodities by internet	G14	-
O1	buy and sell by internet	O2	connecting to all finance and commodity markets via the internet
O3	People do not buy anything in market and buy and sell what they need at home	O4	communicating with the world markets
O5	e-trading, buying and selling by internet	O6	transferring money by internet
O7	communicating with organisation's divisions and stakeholders by web	O8	sell and buy through internet
O9	doing business processes electronically	O10	if we consider that an organisation works based on a business model, e-business is to do this business model through IT systems and internet (web)
O11	-	O12	e-trading like Amazon and e-bay
O13	e-banking, selling and buying by internet	O14	selling and buying by internet
O15	linking organisational intranet and internet and web for achieving the organisational objectives with maximum of efficiency and productivity	O16	e-trading like Amazon and e-bay
O17	to do the activities electronically		

Table 5-3: Definition of e-Business by managers and experts of NIOC and NIGC

The HR manager of NIOC (O3) mentioned that "the central aim of e-business is to detect HR processes and activities for converting them to IT systems via internet." The distribution manager of NIGC (G11) pointed out that "e-business advantages are included in this management:

❖ Not required to attend to customers in our offices

❖ Connecting with suppliers (commodities and services)

❖ Connecting with contractors

❖ Accessing incident information quickly

❖ Payments"

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Managers do not believe in the designed IT systems. Some experts (G2, G6, G7, G10, G14, O1, O3, O4, O8, O11, O14, O15 and O16) emphasised that while the required systems have been provided, some managers prefer to use the traditional methods to do their task and activities.

The law manager of NIGC (G6) mentioned that "we know e-business systems can help us to manage the legal affairs, but the high volume of work and everydayness does not allow us to re-think our work processes and activities and design any systems, because it is time consuming."

The experts explained their organisation's e-business systems and how they connect to stakeholders. Tables 5-4 and 5-5 show different e-business systems and their relationships with individuals, departments, suppliers, partners, communities and customers. Some e-business systems of Table 5-4 and Table 5-5 have been explained in sub-propositions of proposition 1.

		Individuals & Departments	Suppliers	Partners & Communities	Customers
G1		Activities on HSE website: • Performance reports • Regulations and instructions • Training • Introduction of divisions • Performance assessment • HSE news	• Introducing new HSE training courses via website • Purchasing the required equipment and commodities via website	-	• Introducing new HSE training courses via website • Access to the required documents and software via website • Incident analysis system • Recognition of hazards
G2		• Comprehensive system of HR for personal, educational and promotional information • Enterprise Resource Planning (ERP) system	• Elite recruitment system • HR supply system	Government messaging system	• Feedback and suggestion system • Knowledge management system • e-Learning
G3		Comprehensive system of HR for identified HR training	Introducing new HR training courses via website	-	Introducing new HR training courses via website
G4		-	Purchase management system	-	• Access to the required documents via website • Purchase management system
G5		-	Project management system	-	Comprehensive KM system
G7		e-Org	• An information bank that information of experts, employees and projects • Project management system: activities in respects to projects,	-	• An information bank that information of experts, employees and projects • Project management system: activities in respects to projects,

	Individuals & Departments	Suppliers	Partners & Communities	Customers
		thesis's are controlled and evaluated		• thesis's are • controlled and evaluated
G8	Documentation management system	-	-	-
G9	• Refinery management system for • Supervising the production and quality of gas • Major repairs • Waste control • Level of energy usage	Purchase management system	-	• Inventory system • Refinery management system for 1. Supervising the production and quality of gas 2. Major repairs 3. Waste control 4. Level of energy usage
G10	Decision support system	-	• Weather forecasting system (linked to Meteorological Organisation: this system measures gas consumption based on the temperature. • It gathers all temperatures of cities and gives the consumption rate for each city.	• SKADA system: • Controlling gas pressure, quality and quantity (refineries, stations, pipelines, • consumptions and export and import points) • Following up, measuring and reducing the missed gas
G11	e-Org	Purchase system for goods and services	-	• Customer relationship management: Using the website (internet) for the customers which do not require to attend to offices and can perform every things via the website • Satisfaction assessment system of customers
G12	Statistic and report system	Goods and inventory system	-	Project management system
G14	PMIS (project assessment)	-	-	-

Table 5-4: e-Business systems and their relationships with stakeholders in NIGC

	Individuals & Departments	Suppliers	Partners & Communities	Customers
O1	• Barid (administrative automation) • Kerosene management system • Dynamic Report System: (Sale Analysis)	• Easy trade system • Dynamic reports system: Oil Products' Delivery Vouchers	The system for identifying small consumers in the agriculture sector	• Internet fuel sales system • Oil products' request system
O2	• HSE performance management	• Purchase of the required equipment	-	• Determination, management and

		and commodities via website		• evaluation of the potential risks of damage • Risk management of projects
O3	• Performance evaluation system • e-Org • Integrate all training systems	• Integrated goods system • Elite recruitment system • HR supply system	Government messaging system	• e-Learning • Web-based portal: • Recruit top students in the universities • Recruit the required personnel
O4	• Documentation management system • Expert forums	Introducing new projects via website	-	-
O5	-	Project management system	-	Comprehensive KM system
O6	e-Org	• Project management system: activities in respects to projects, thesis's are controlled and evaluated • An information bank that information of experts, employees and projects	-	• Project management system: activities in respects to projects, thesis's are controlled and evaluated • An information bank that information of experts, employees and projects
O7	Project management system	-	-	Project management system
O8	Documentation management system	-	-	Documentation management system
O9	• Share point Software • Enterprise Project Management (EPM)	Enterprise Project Management (EPM)	-	Upstream data system
O10	Project management system	-	-	Project management system
O11	e-Org	A web-based portal for oil and gas auctions	-	-
O12	• Barid • e-Org	-	-	-
O13	Oil Depots' Online Monitoring System	Control projects by ECPM	Upstream information system	Control projects by ECPM
O14	e-Org	Purchase management system	-	Purchase management system
O15	• Fully Automated Pilot Project • Smart fuel system	• Smart fuel system • Oil Depots' Mechanised System	Smart fuel system	• Fully Automated Pilot Project • Smart fuel system
O16	Dispatching system	-	-	Tanks Automatic Gauging Systems
O17	Internet site for determining the fee of the transportation routes	Payment system for transportation of the four main products	Payment system for railway transportation fee	Transport Fleet's Internet Base

Table 5-5: e-Business systems and their relationships with stakeholders in NIOC

Briefly, the definitions and the advantages of e-business and also the relationships between e-business and stakeholders, which were explained by the experts, demonstrate that they do not have an appropriate conception of e-business. According to the e-business definition in the research, it is a web-based information technology which is used by organisations to link internal communications between employees, and integration between departments and external collaborations with suppliers, customers, communities, strategic entities and partners in an organisation. But, the majority of the experts explained that it is "buy and sell via internet". Also, table 5-3 demonstrates that their e-business systems are incomplete. It means that e-business systems have not been linked to the other stakeholders in accordance with the e-business definition in the research. On the other hand, when experts were asked about the advantages or system of e-business, they only considered the requirements of their management in e-business, and did not consider other parts of the organisation that need to develop the knowledge of this management. As a result, the results show that there is not a clear e-business strategy in the subsidiaries and the cases which do are based on the internal capabilities of the subsidiaries and are not based on a formulated e-business strategy that is developed and communicated in the organisation.

Proposotion1-1: Sound and appropriate technology is adopted and implemented.

Discussion: As explained in the literature review, technology focuses on two views. The First view focuses on the hardware including equipment, instruments and machines; and the people that work with them in productive activities (Zuboff, 1988). In the second view, technology is stated as the social technologies (software) that include the techniques, procedures, generic tasks and knowledge of people when they engage in their productive activities (Eveland, 1986).

Based on the two mentioned views of technology, the hardware and software of e-business is studied in NIOC and NIGC. First some evidence of hardware and software was explained separately and then, the researcher discussed the technological situation in the subsidiaries.

This part is involves some evidence about hardware. The majority of experts (O3, O5, O9, O13, O15, G1, G2, G7, G10 and G14) explained, "NIOC and NIGC have enough financial resources and can provide the required equipment, machines, instruments, software and systems while their organisations are sanctioned to buy some of them; but they can provide them with upper prices". Therefore, they do not have any problems with the supply of the required equipment. The infrastructures of e-business are when their barriers were mentioned for implementing e-business systems." Some stakeholders are not interested in using the designed systems on the

web. The manager of international and commercial affairs of NIGC (G4) described that "Purchase Management System is an application which our suppliers should use to import our required data, but some suppliers do not import them and send data traditionally to us. They explained that they did not have enough personnel to do it". Also, some stakeholders lack the appropriate technological infrastructure, equipment and instruments of especially in new oil and gas fields and operational areas like satellites, optical fibre and the required equipment for connecting to the web. Exploration manager of NIOC (O9) stated that "unfortunately, some suppliers do not have advanced equipment while our designed equipment resolves our needs. This is because our systems are not efficient and productive."

This part involves some evidence about software. The majority of experts discussed that information security is a vital factor in not using web-based systems or connecting to other systems via internet (web). For instance, the KM division manager of NIGC (G5) mentioned that "several times hackers have attacked their e-business systems, because the systems have not been designed to prevent these attacks properly." Therefore, the companies do not connect to the web and prefer to use intranet as a safe network. The Manager of IGEDC (G12) explained that "The systems have been designed to do specific tasks and cannot connect to other systems. IT designers and experts have to re-design or modify systems which have considerable costs for the organisations." therefore, the systems are unintegrated and work separately and do not connect together. The Structure manager of NIOC (O8) stated that "for this reason, the systems are not efficient and effective, even when they are designed. Consequently, IT companies cannot update and customise the existing systems properly, because they lack or have low knowledge about the oil and gas industry. The technology manager (O12) explained that "some e-business systems have capabilities to link other systems, but unfortunately our experts do not inform them. On the other hand, because of other reasons like everydayness and numerous tasks, they are not keen to get familiar with new and current techniques, methods, software and equipment and do their task effectively and efficiently". Managers do not believe in the designed IT systems. Some experts (G2, G6, G7, G10, G14, O1, O3, O4, O8, O11, O14, O15 and O16) emphasised while the required systems have been provided, some managers prefer to use the traditional methods to do their task and activities. Manager of IOPTC (O17) described that "managers usually decide individually and do not consult with their staff when an e-business system wants to design in the organisation". The R&D manager of NIOC (O6) mentioned that "the managers are usually selected politically while it is possible for them to even be selected from other companies. Therefore, it takes time for them to become familiar with the organisation's systems and the existing problems. Even in some cases, they do not believe the current systems and the organisation are forced to change the existing systems". The distribution manager of NIGC (G11) said that "we designed a new website for our management,

but a manager should sign it up. Unfortunately, it only lasted for one year and the manager was changed. The next manager did not believe in the designed website. Thus, we had to design a new website and this lasted about 2 years". Therefore, the permits and managers' signatures and also a meeting with managers and experts are required for deciding and designing a new system or modifying the current systems. Thus, it takes several months. Also, some permits do not allow changes to the new systems. The Vice-manager of IIES (O4) described that "the main task of our institute is research and development for different oil and gas parts, thus our systems should be linked with several research and scientific centres in the world. But, the organisation's regulations do not allow our systems to link to them and this relationship is one-way in nature." The Manager of export and international affairs of NIOC (O1) explained that "the oil and gas companies (producers of crude oil and oil products) have specific customers and the customers cannot easily change their suppliers because they provide their technology and equipment in accordance with the kind of crude oil or oil products that they buy. Thus, there is no real competition (monopoly) in the oil and gas markets." The Law manager of NIGC (G6) mentioned that "we know e-business systems can help us to manage the law affairs, but high volume of works and everydayness does not allow us to re-think our work processes and activities and design any system, because it is time consuming." The KM manager of NIOC (O5) that "some staff members do not know the capabilities of the current system like e-Org which is an application of HR in NIOC and NIGC. They request to design new systems that can resolve their needs with e-Org easily". The HSE manager of NIGC (G1) described that "we do not have forums or networks where staff members discuss the advantages and disadvantages of the current systems. These networks and forums can lead to designing new systems or developing the current systems". Thus, the lack of professional and technical networks and forums lead to the inability to design new systems or modify and customise the current systems.

Discussion: the aforementioned evidence demonstrates that the subsidiaries do not have a serious problem in the supply of the required equipment. This is because they work in a strategic industry that the country relies on to sell their products. While they are sanctioned to buy the required equipment, a clear strategy has been permitted to them till they can buy the equipment at even higher prices. But, they have a problem with the infrastructure of the hardware when they intend to connect to the stakeholders. As mentioned in the evidence, the stakeholders do not have the required equipment or interest to use the systems. The subsidiaries do not have a clear e-business strategy in relation to the infrastructure of hardware in technology. With respect to the software, it is clear that they have essential problems in designing, customising, buying (outsourcing the design of the required software) and using the software. The problem is that they do not have a clear e-business strategy regarding them and

possible successes (G10 and O15). This will be mentioned in the next propositions as it is completely related to the internal capabilities of the subsidiaries.

Proposition 1-2: Integrated development of functional and operational information within the organisation (individuals and departments) facilitated.

Discussion: the Integration of functional and operational information between individuals and the department of the organisation when a clear e-business strategy has been used in the organisation have been discussed.

Table 5-4 demonstrates that most e-business systems, which the subsidiaries NIOC and NIGC are using are related the within organisations (individual and departments). Despite the fact that their e-business systems are different from the research definition of e-business, they recognise the requirements of their knowledge within organisations properly. Some evidence in the subsidiaries of NIGC and NIOC are mentioned.

The HSE vice-manager of NIGC (G1) explained that "the management are using a web-based system for doing their activities like performance reports, regulations and instructions, training, introduction of divisions, performance assessment and news of HSE". Also, the Planning manager of NIGC (G14) described his experience when he got familiar with Meeting Management System of Trans Canada Company. They designed this system for preparing employees to gain required information in meetings.

The HR managers of NIOC and NIGC (G2 and O3) talked about their HR system called e-Org. e-Org is a comprehensive system of HR for the educational and promotional information of personnel. It can indicate the training requirements of personnel.

As a result, the subsidiaries have defined their e-business strategies incompletely; because they recognise their internal requirements and are familiar with other parts of the organisation, they are successful in e-business systems, especially in project managements like Exploration management (O9). However, the e-business systems have been designed not to link to the other systems of the other departments. For instance, e-Org is a comprehensive system and success for HR, but it cannot launch the required information of HSE for HR. Therefore, the designed e-business systems work separately from other stakeholders.

Proposition 1-3: Exchange of operational and logistical information with suppliers facilitated.

Discussion: This proposition has a view to suppliers with respect to how clear e-business strategies, which are developed and communicated in the organisation, can exchange operational and logistical information with suppliers. First, some activities of the companies with suppliers are explained and the results are discussed.

The most important activities of Purchase Management System of Management of International and Commercial affairs are (G9):

- Internal resource evaluation (internal producers /suppliers companies)

- External resource evaluation (external producers/ suppliers companies)

- Contractor resource evaluation and commercial research (including companies of contractors, consultants, services, exploitation and maintenance)

The Company of Manufacturing Support & Procurement Kala Naft (O14) has a comprehensive purchase system of commodities. The system is allowed to view the inventory of the subsidiaries' stores and prevent buying excess commodities for the stores.

HR managements (G2 and O3) use a web-based system to recruit the required personnel. First this system was designed by NIGC for applicants to submit their information to the NIGC website and then register and attach the required documents. But this system has been developed and applied in both NIGC and NIOC. But it is only enabled to receive information and send the results to the applicants; and it cannot evaluate the applicants and give feedback to recruitment personnel and applicants.

R&D management (G7 and O6) use a project management system which is web-based. It can communicate with researchers and research centres (suppliers of research services). Also, the research centres (universities and companies) can view the project situation easily. An information system of exports has been implemented which also helps to carry out new projects. However, their systems are only able to receive and send information and are not able to evaluate and analyse the information.

The R&D vice-manager of NIGC (G7) stated that "this management are using some applications which work on the web for communication and interaction with researchers, research centres, research resources of universities and companies. The projects are on this

system, thus the research centres and companies can view them easily. Also a comprehensive information system has been implemented for exports of projects in NIGC which is accessible for users and helps us to carry out new projects."

As mentioned in the evidence of the proposition, to buy equipment and commodities, to carry out HR services and research projects and recruitment comprise the majority of communications with suppliers in NIOC and NIGC. These communications are clear in the Management of International and Commercial Affairs (G4) and company of Manufacturing Support & Procurement Kala Naft (O14) for buying equipment and commodities, HR managements (G2 and O3) for carrying out HR services and recruitment and R&D managements (G7 and O6) for doing research projects.

The e-Business systems of the subsidiaries have a serious barrier in terms of their communication with their suppliers. Information security as discussed in propostion1-1 prevents them from connecting to suppliers in the subsidiaries. Oil and gas industries in countries with oil-based economies are highly sensitive. Information security his has caused that prevents them from formulating an appropriate e-business strategy in the subsidiaries. On the other hand, some suppliers are not interested in connecting to the e-business system and some do not have appropriate equipment. The oil and gas market is a monopoly market; it means oil and gas companies have unique customers as discussed previously. This causes them not to develop the current e-business systems because they work in a market without any competitors.

Proposition 1-4: Exchange and share of strategic and operational information with external partners and communities facilitated.

Discussion: When a clear e-business strategy has been designed, which is developed and communicated, it can facilitate exchange strategic and operational information with external partners and communities. According to the proposition, some evidence of e-business systems that are being used to communicate with external partners and communities, are explained and then, they are discussed.

G2 and O3 are HR managements of NIGC and NIOC. Their main tasks are recruitment, training, promoting and planning of HR. Therefore, they have various e-business systems to communicate with external environment. They also use a web-based system for communication

with government. This system is Government Messaging System that receives the formulated policies, strategies and regulations related to NIOC and NIGC from government.

Dispatching management (G10) is a best practice in the design of an e-business system called SKADA in NIGC. NIGC manages the operation of the gas supply network with more than 150 billion cubic meters of annual production, the world's fourth largest producer of gas. With 33,000 km of high pressure pipelines and a large number of clients within the public sector as well as private commercial companies. The main duties of Dispatching management include the coordination between different production departments for transmission, distribution, quality measurements and supervision of various processes. SKADA is a system used to collect and analyse data from production, transmission and distribution units of gas. The advantages of SKADA system include:

- Controlling gas pressure, quality and quantity (refineries, stations, pipelines, consumptions and export and import points)

- Following up, measuring and reducing the lost gas

SKADA has also been equipped with a Weather Forecasting System. This system measures gas consumption based on the temperature. It gathers all temperatures of cities and gives the consumption rate to each city. Weather forecasting system has linked to Meteorological Organisation. When the weather temperature of a city reduces strongly, it causes a reduction in the pressure of the gas and consequently leads to a cut in the gas flow. SKADA increases the pressure of the gas flow when the weather temperature reduces. Therefore, it does not permit to cut the gas flow in any city.

The mentioned evidence and table 14 demonstrate that the subsidiaries of NIOC and NIGC have used less e-business systems in connection with their partners and communities. Therefore, clear e-business strategies have not been designed in the subsidiaries. Information security is a key factor to prevent an e-business strategy in them. E-Government and project management system are e-business systems that are being used. Government has made NIOC and NIGC use the system of e-Government. However, the project management system is a successful system in the subsidiaries. An oil and project has many suppliers, partners, contractors, customers, etc. The stakeholders of a project should attend to the subsidiaries by having meetings, exchanging documents and information, etc. Therefore the subsidiaries have had to design a project management system with which the stakeholders can view the situation of the project and obtain the required information and documents via the system. Thus, one of successful e-business

system of NIOC and NIGC is project management system as mentioned in HR and Exploration managements.

Proposition 1-5: Clear communication and exchange of information with customers facilitated to support customer services and keep them satisfied.

Discussion: e-Business strategies that are clear and communicated via knowledge network and developed by technology facilitate communication and exchange information with customers. Some evidence is mentioned and discussed here.

Managements of Export and International Affairs (O1), Distribution (G11), International and Commercial affairs (G4) and National Iranian Oil Production Distribution Co. (NIOPDC) (O15) are only subsidiary companies that sell oil, gas and their products to customers directly; but the rest of subsidiaries' customers are other SBUs and subsidiary companies of NIGC and NIOC. Therefore, G4, G11, O1 and O15 only use e-business systems that have interaction with external customers.

R&D management of NIOC (O6) use a portal on the web to manage their projects. The objectives of this project management system are supervision and control of the research projects, proposals and students' thesis, which are related to NIOC activities. The system links to subsidiaries, research centres and universities. Also it has an outstanding capability for managers, experts, students and researchers to view the whole process of research project from the first to the last phase.

Smart Fuel System of NIOPDC (O15) is also a unique e-business system. The system is uses a smart card, which is linked to the group of software, hardware and communicating networks that mechanise all the fuel supplying processes carried out by the smart fuel card. The system is a good base to exert numerous activities, like: exact accessibility to the figures and statistics of consumed fuel by transportation sector across the country in order that gas conservation, energy efficiency and paying fuel price to be facilitated electrically. The system was formally launched in NIOC in 2007. NIOPDC is responsible for directing, monitoring and supporting the smart card services in more than 3000 supplying centres. These responsibilities are among the items below:

- Control fuel distribution and consumption process

- Provide statistical, comparative and executive reports to the related institutions.

- Perform rationing and supplying policies with different pricing

- Capacity-expanding for different types of fuel supply with respect to transporting vehicles and facilitating new change in prices.

- Enhancing the policy of decreasing cash rate, increasing security rate in supplying routes through operating electronic payment system at the stations.

The Distribution manager of NIGC (G11) explained that their web-based system is related to their customers. The system can do the activities of virtual training, feedback and suggestions system, bill payment, controlling pressure and temperature from TBS (Town Border Station) and CGS (City Gate Station) stations and commodity inventory system.

Briefly, there are some systems and networks used to communicate and exchange information with customers, almost all of them are incomplete and work separately from other divisions of the organisation. Therefore, the subsidiaries do not have clear e-business strategies that are developed and communicated to customers. Nevertheless, some systems are effective and efficient, because they have been designed according to specific conditions which have been in the organisation or the country and not designed based on doing the work effectively and efficiently. For example, the Fuel smart system was designed when the petrol consumption was high and the country had encountered a serious crisis. On the other hand, the system of SKADA has been designed based on the internal capabilities of the Dispatching management which is a unique and best practice in the world. Therefore, if a clear policy and its relationships with performance of the organisation have been clarified for instance the Smart Fuel System or when benefits of the country and the support of top level managers as well as the internal capabilities have been provided in an organisation for instance system of SKADA, a clear communicated e-business strategy has been made.

Conclusion

When the subsidiaries of NIOC and NIGC have a proper perspective and appropriate conception from their internal and external environment of the organisation, a clear developed and communicated e-business strategy can be successful in their organisations. The internal capabilities and condition of the country have caused some e-business strategies to be successful locally for instance Smart Fuel System and SKADA. It means that they have not been communicated with other stakeholders in accordance with the definition of e-business in the research. It is clear that the subsidiaries have strategies as mentioned in Tables 5-4 and 5-5, but they have been designed incompletely. They provided almost all the required equipment, machines and instruments (hardware), Even though providing some hardware is expensive with respect to the sanctions. However, software is the vital problem in NIGC and NIOC. They have

weaknesses in the recognition of the required new applications, methods, systems and procedures. Not having relationships with other subsidiaries and other companies means they cannot improve the current software and hardware and provide the appropriate new technologies. The most important activity of subsidiaries is the management of projects. Consequently, as mentioned in the tables (5-4 and 5-5), most of e-business systems are project management systems. It shows that to carry out projects in time and cost effective manners, project management has a critical role for oil and gas companies.

The most important e-business activities and systems of NIOC and NIGC include:

- ❖ Feedback, suggestions and consultations

- ❖ Buy the required equipment and commodities

- ❖ Sell oil and gas products to retailers and end-consumers, but not crude oil and natural gas (they are sold and bought in the oil and gas market by representatives of NIOC and NIGC)

- ❖ Online-training: seminars, workshops, etc. with other companies or universities or research centres

- ❖ Repairs and maintenance: expert panels, video conference for making a decision and solving a problem

- ❖ Provide the required workforce and contractors for carrying out the projects

Proposition 2: Clearly developed and communicated strategies for knowledge management will lead to realised and communicated knowledge within the organisation (through a KMS).

Discussion: This proposition discusses the KM strategies of NIOC and NIGC. KM is a familiar concept in NIGC and NIOC and almost all the experts knew definition, process and components of KM, because some KM projects have already been done in their companies. Table 5-6 shows definitions of KM which were mentioned by the experts.

Company/ SBU	Definition	Company/ SBU	Definition
G1	-	G2	Enriched and developed information and recognising sets of skills that can resolve an issue
G3	Extract and use knowledge of employees for satisfying the needs of organisation	G4	IT system that collects all information of commodities. In fact, it is an information system for purchasing
G5	Using knowledge of people for maximising efficiency, effectiveness and productivity	G6	-
G7	-	G8	Sharing knowledge
G9	Using employees entire ability to achieve company goals	G10	-
G11	Exploit information	G12	Managing knowledge of inside and outside organisation in order to maximise productivity of organisation
G13	a documentation management system that collects all information of projects	G14	knowing the rules of game at the international levels
O1	To gather, categorise, analyse and apply the existing knowledge between employees and stakeholders	O2	Transferring the existing knowledge to an appropriate user in an appropriate time
O3	To gather, analyse and use the existing knowledge through KM systems	O4	Sharing the experiences
O5	Process of gathering, categorising, analysing and exploiting explicit and tacit knowledge	O6	Transferring information between different division of an organisation
O7	To convert tacit knowledge to explicit knowledge	O8	Using knowledge of mangers and experts at work
O9	Managing the achieved experiences of past, present and future properly	O10	Managing the organisational knowledge and converting tacit to explicit knowledge while the experts can use it in their tasks and activities
O11	Documenting the experiences in a dynamic system for using experts	O12	Sharing knowledge between employees
O13	-	O14	using the existing knowledge in appropriate place and time
O15	Sharing knowledge for achieving the organisation objectives	O16	Managing the knowledge of projects for the users
O17	To collect the knowledge of experts in a system and share it with stakeholders		

Table 5-6: Definitions of KM by interviewees in NIGC and NIOC

Some experts defined KM in their activities and referred to KM advantages, as well. The following paragraphs explain the KM systems in NIOC and NIGC in more details..

The Dispatching manager (G10) stated that "KM can be an advanced decision support system. When a decision is made, the system will illustrate how many times this decision has been made before and the outcome it has had?"

The Planning manager of NIGC (G14) stated that "as the main task of planning management is to produce expert reports, accessing to the subsidiaries' knowledge and international companies

within our field; the goal of KM is to know the game rules at the international levels in the oil and gas industry".

The HR manager of NIGC (G2) mentioned that "Knowledge management is integrated, structured, enriched and developed information to identify skills that can resolve an issue. Also, knowledge is important because it helps the organisation in competition with competitors, cost effectiveness, new knowledge acquisition in the work environment, retirement and replacement of expert workforce."

The Planner manager of NIOC (O13) explained that "The knowledge systems should be two-way systems; it means that they extract the experts' knowledge and on the other hand, the experts launch the systems, this is KMS. Unfortunately, everydayness is a main factor in reducing the motivation in knowledge sharing and the organisation should prevent everydayness among personnel with appropriate solutions".

The HR manager of NIGC (G2) talked about the aims of knowledge sharing in this management:

- Providing the required workforce

- Empowerment and effectiveness in HR creativity

- Fostering and developing employees talents and skills

- Fulfilling employees needs

- Maintaining a good relationship between employees

The Coordination and Supervisory of Production manager of NIGC (G9) discussed how KM systems can increase exploitation and production in the shared reservoirs of gas and petroleum with neighbouring countries.

According to the definition of KM in table 5-6 and the explanations of the experts, it is clear that there are no clear KM strategies that are communicated, because the definitions are different and incomplete. Also, the definitions show that knowledge sharing should only be carried out through KM systems. However, although other systems, such as documentation systems, ERP and etc., are classified as KM systems, because of their naming, the experts are unaware that they are classified as KM systems as well.

Proposition 2-1: Knowledge is acquired through various means, distributed through various channels, and utilised in various modes and areas.

Discussion: this proposition explains that clear KM strategies that are communicated and developed to facilitate the processes of acquisition, distribution and utilisation of knowledge. Table 5-7 demonstrates KM methods in the subsidiaries of NIGC and NIOC. The KM methods have been categorised based on the KBO model of the research. Some KM methods have been discussed in the next paragraphs.

KM Process	Cases	KM Methods
Acquisition Means	**NIGC**	• Comprehensive system of KM (G2) • Knowledge acquisition system (G2) • Barid (G6) • e-Org (G1) • Professional forums: consultants committee (thought engineering) and research council (G7) • Professional networks: Transmission, Provincial gas, Refinement engineering and development, Headquarter and Southern Pars (G8) • COPs for Performance assessment, Increasing productivity, Assessing problems and new issues in works and Aiming subsidies (G11) • COPs for Circular formulation team and Cultural committee (G12) • Methods formulation committee: EPC and PC (G12) • Professional COPs in Refining, Ethan, LPG, International relationships, Energy management (G14)
	NIOC	• Barid (administrative automation) (O1, O6) • HR knowledge networks: Replacement plan of managers, Job evaluation, Job unification, Training calendar, Recruitment, Placement and Dispatch abroad (O3) • Knowledge acquisition system (O5) • Barid system: to do administrative correspondence through software on intranet (O6) • Professional and technical COPs (O7) • Think-tanks for different issues (O8) • Common meetings for formulating new regulations and procedures of organisation structure (O8) • Lesson learn projects (O9) • Barid (O12) • e-Org (O12)
Distribution Channels	**NIGC**	• Administrative Automation (G1) • e-Learning, e-library and e-training (G3) • Knowledge management system (G5) • Documentation management system (G8) • Network optimizing system (G10) • Knowledge exchange panels: Applying the retired staff in different projects and Training though an expert superior (G12) • Documentation management system (G13) • Writing a book about experience of NIGC's CEOs (G4)
	NIOC	• Risk management system (O2) • Knowledge network between R&D divisions of subsidiaries (O6)

		• Professional panels with subsidiaries for sharing experience and solving the problems (O6) • Documentation management system (O4, O6, O7, O8) • Knowledge management system (O7) • Share point Software (O9) • A web-based portal for oil and gas auctions (O11) • Transport Fleet's Internet Base (O17)
Utilisation Modes	**NIGC**	• Comprehensive training system (G3) • Purchase comprehensive system (G4) • Inventory system (G9) • Refinery management system (G9) • Decision Support System (G10)
	NIOC	• Kerosene management system (O1) • HSE performance management (O2) • Project management system (O4) • Comprehensive system of KM (O5) • Enterprise Project Management (O9) • Project management system (O9) • Control projects by ECPM (O13) • Upstream information system (O13) • Purchase management system (O14) • Smart fuel system (O15) • Fully Automated Pilot Project (O15) • Dispatching system (O16) • Internet site for determining the fee of the transportation routes (O17)

Table 5-7: KM methods in NIGC and NIOC

The head of the KM Division in NIGC (G2) explained that "two KM projects (Comprehensive system of KM and Knowledge acquisition system of experts) were carried out in NIGC. The first KM project was knowledge acquisition of the experts and managers. This project extracted the knowledge of 50 managers and experts, who were retiring and leaving the organisation by interviewing them. The output of this project was the booklets of knowledge for each manager or expert and also we implemented these booklets into software. Unfortunately, the software was not applied by the users, because there had many problems with it. Another KM project is based on software that should be filled out by the personnel. Finally, the extracted knowledge will then be sent out to the corresponding employees. We have failure in both projects".

The HR manager of NIGC (G3) stated that "we use comprehensive software which can collect the requirements of training for other divisions and subsidiaries. Then, the experts gather the needs after designing the training courses."

The Manager of International and Commercial Affairs (G4) has an outstanding book. The manager interviewed six CEOs of NIGC and published it based on his interviews. The interviews with the CEOs have lasted nearly four years.

The Structure manager of NIGC (G8) mentioned that "our KM activities include making a server, a shared folder for writing, backup reports and working groups. These working groups are COPs of our management. They divided into five groups of transmission, provincial gas, refinement, engineering and development, and Southern Pars.

Running meetings via video conference and building a knowledge network to integrate the knowledge refineries are the main activities of Coordination and Supervisory of Production Management (G9). The advantages of this knowledge network are time and cost efficiency and running meetings in any weather conditions.

Dispatching management (G10) has been used in three KM systems. SKADA, DSS and Weather Forecasting System. DSS (Decision Support System) is like a simulator which can evaluate the results, identify all events and recognise all the substitutable moves. Thus, it helps to provide the required documents. SKADA and Weather Forecasting System are explained in the last parts. The manager believes that "SKADA is a unique system and best practise in the world. The managers and experts of Trans Canada and Gazprom (Russia) companies have approved the system as a best practice for controlling and managing gas transmission in the world".

Distribution management (G11) has professional networks with main activities such as performance assessment, increasing productivity, assessing problems of subsidiaries. Also Iranian Gas Engineering and Development Co (G12) and Planning management (G14) have been used COPs as a knowledge network.

The Iranian Gas Engineering and Development Company (G12) has knowledge networks, which include the circular formulation team, cultural committee and the methods formulation committee. Also, planning management (G14) has formed the knowledge networks for refining, Ethan, LPG, international relationships and energy management.

The HR management of NIOC (O3) has carried out two KM projects which are similar to KM projects of NIGC (G3). They include the knowledge acquisition of an expert and comprehensive KM system. Also, this management has made some knowledge networks and believes that the objective of the HR knowledge networks is to improve HR processes and activities continuously (as mentioned in Table 5-7). The model of the HR knowledge networks is based on four activities: evaluating the current situation, determining the best situation that all the HR divisions, helping to develop it and, formulating a procedure and action.

Implementation and evaluation of KM projects of NIOC is the task of KM division of NIOC (O5). The head of KM division discussed that KM projects have being carried out with two purposes; documenting the experience of experts and extracting the knowledge of experts and managers. The applied methodology of the KM projects consists of five main steps which are recognition, training, knowledge acquisition, knowledge edition and Knowledge of database design and implementation of e-learning package. The head of KM division believes that their KM projects have the following results and achievements:

❖ Developing the knowledge tree of NIOC with nearly 375 knowledge branches in subsidiary companies

❖ Documentation of 200 experiences

❖ Access to a vast bank of knowledge in the fields of management and technical knowledge

❖ The installation and placement of web-based application with the ability to retrieve, evaluate and enrich the knowledge

❖ Studying how to document experiences of the experts in the oil industry

❖ Providing knowledge handbooks of the experts

❖ Creating a computer knowledge database which is extracted with a variety of classification and retrieval (collectively)

❖ Also, a KM project is being designed that covers all technical projects of NIOC and in fact, it is a documentation management system. All information within the project is collected in the system and it makes a link between NIOC and its subsidiary companies.

Briefly, as mentioned, NIOC and NIGC have KM divisions in their organisation. This shows that they have KM strategies that the divisions have established. The KM strategies have been formulated to extract the knowledge of some managers and experts were retiring and leaving the organisation. The managers intend to share the collected knowledge with individuals and departments of the organisations. Therefore, they have focused on two KM projects of Comprehensive KM system and Knowledge Acquisition system while personnel and even experts do not interest to share their knowledge. Therefore, this demonstrates that clear KM strategies have not been existed, which are communicated. Consequently, KM strategies are incomplete and this have caused that the expert have different conceptions from KM. Also, these incomplete KM strategies are clear when the experts explained KM methods in their

organisations. Most of the KM projects of NIOC and NIGC have been designed separately and have not been linked other parts of organisation for instance, Documentation Management System. The experts believed that comprehensive KM system and knowledge acquisition system (two KM projects previously implemented in the two companies) were not designed properly. Therefore, the systems were not used by experts and personnel. Two KM systems failed because of not having the comments and feedback of experts and several problems in their application. This shows that communication with experts is not a part of the designed KM strategies in NIOC and NIGC, thus KM strategies have not been communicated and also they have not been developed, because of several problems in application.

Proposition 2-2: Knowledge is networked and shared with stakeholders, within the set strategies and policies, through set up e-enabled networks

Discussion: The previous part showed that NIOC and NIGC have KM strategies that have focused on individuals and departments. But some subsidiaries have been connected to other stakeholders through KM activities. This part discusses how KM strategies, which are communicated and developed, can connect the subsidiaries with their stakeholders via e-enabled network. The following paragraphs contain the relevant evidence in the subsidiaries.

Dispatching management (G10) has been developing the knowledge of the personnel via interaction with other similar organisations. They are using a Decision Support System (DSS) which lunches the required knowledge from inside and outside the organisation through communication between the experts of the organisation and other organisations.

The Manager of NIORDC (O16) mentioned that KM systems can help us through e-enabled networks to update the knowledge of personnel, to recognise, replace and retire the experts, to provide the requirements of personnel, to supply the required workforce, to share the required knowledge between personnel, to increase the quality of decisions, projects and reports, and to reduce cost and time of the operation processes.

The Distribution manager (G11) believes that if personnel do not involve formulating the mission, vision, objectives and strategies of KM in the organisation, they do not know their task, activities and their relationships with other subsidiaries with respect to the formulated KM strategies, as a result they will be failed in the organisation. Also, employees are unwilling to share their knowledge as they claim that their knowledge is their intellectual property. They believe that the chance of replacement and losing their positions are increased by sharing their knowledge.

IGEDC (G12) have been using a system which collects the comments and feedbacks of the retired and released managers and experts for the new and current projects and trains the fresh personnel, as well.

International and Commercial Affairs of NIGC (G4) interact with suppliers and markets through Purchase Comprehensive System which connect to all subsidiaries. The main activities of the system are to use just one method for purchase, to make a data centre, which collects knowledge from the subsidiaries and to evaluate commodity inventory of the subsidiaries.

The Structure manager of NIGC (G8) explained the reasons that lead to failure in NIGS's knowledge management projects. They are including the software is faulty, the employees are not persuaded to carry it out and culture context has not been made

The Structure management of NIGC (G8) has some knowledge networks which collect the required knowledge. They have made some e-Group on the web that almost all managers and experts are its members. They run their meetings via a web-based system called WizIQ. Also some social networks have been used like Skype for communicating with people who are outside the country. Also, the technical experts have some professional forums on the web for interaction with the managers and experts directly.

Summarily, the evidence demonstrates that NIOC and NIGC have KM strategies that are incomplete. Some subsidiaries have COPs, professional forums (Table 5-7) and even e-enabled networks to communicate with their stakeholders for instance the Structure management of NIGC. These communications have been formed locally and have not been linked to other stakeholders. Therefore, KM strategies of NIOC and NIGC are not communicated to link the stakeholders. Also, the technologies that have been used are not based on KM strategies and the subsidiaries use social networks and internal servers. Thus, KM strategies have not been developed.

Conclusion

NIOC and NIGC have KM strategies, because they have KM divisions in their organisation. But, the strategies have not been clear with respect to different conception and definition of the experts from KM. Also, Two KM projects of Knowledge Acquisition System and Comprehensive management system carried out and both of them failed in NIOC and NIGC. The KM systems failed because of not having the commentary and feedback of experts and many problems in applications. This shows that communication with experts is not a part of the designed KM strategies in NIOC and NIGC, thus KM strategies have not been communicated

and developed. Project management systems as mentioned in Table 5-7 and also last proposition (e-business) have a key role in the oil and gas industry. They have been designed to cover all requirements of stakeholders, because management of financial resources and to carry out projects on time are important for oil and gas companies. Project management systems are the best KM and e-business systems (G4, G5, G7, G12, O5, O6, O7, O9 and O10) that are linked to the stakeholders and are usually successful. This is because; KM strategies have been formulated by the relevant experts. The required web-based applications have been designed by relevant experts and stakeholders. Therefore, the subsidiaries have KM strategies that are developed and communicated regarding projects.

Proposition 3: Clearly developed and communicated strategies for e-Business and KM when aligned, will lead to development of strategic knowledge resource in the form of knowledge networks.

Proposition 3-1: Integrated KMS facilitating interactive access of stakeholders (individuals, departments, suppliers, communities, partners, customers) to the knowledge.

Proposition 3-2: Shared platforms (technology and systems) are provided to facilitate access to the knowledge.

Discussion: KM strategies and e-business strategies, which are clear in the organisation, have been developed via technology and have been communicated by the experts of the organisation when two strategies are aligned. This alignment has been studied in this proposition. Firstly, some evidence is explained and then the results will be discussed.

HSE manager (G1) explained how the alignment of e-business and KM strategies lead to building the knowledge resources. Environment, safety and health are the most important activities of HSE management. The impacts of this alignment have been explained in the activities of HSE management:

Environment: The alignment divides two parts; the first part is related to a knowledge network which is an internal network of the organisation like regulations and laws, strategies, objectives, instructions manuals, policies, personnel's knowledge and also information of pollutants, equipment, facilities, technical features of equipment, etc. the Second part is to enrich this knowledge network by the web. It can enrich the knowledge network by adding information and knowledge of national and international regulations, environmental services companies, new

standards, technologies and solutions in related to environment. The enriched knowledge helps the managers and experts to decide and select the best solutions for reducing environmental pollutions.

Safety: The internal knowledge network includes the information and knowledge of incidents, personnel's experience, regulations, instructions and procedures, policies, strategies, equipment instructions, conditions and space of work in this division. The knowledge network can be enriched through information of international and national incidents, regulations, standards that are related to the suppliers of the safety equipment. The enriched knowledge network can provide the best safety equipment and formulate the best safety instructions.

The Distribution management of NIGC (G11) has a direct relationship with power plants, and the customers of household and industrial. Pricing and determining tariffs of gas and interaction with the consumers are the main activities of the management. Also, it has communications and relationships with the consumers through the web. The organisation's experts determine the price and tariffs of the gas. But, the policies, procedures, strategies, instructions of NIGC and government and the price of gas in the world markets should be considered by the web. The knowledge network includes the required information of world markets, NIGC, governments, parliament and experts by the alignment of KM and e-business. The network can price and determine the tariffs through taking the suggestions and feedback of the consumers.

The main task of Iranian Gas Engineering and Development Co (G12) is design and construction of gas boosting stations, development of new refineries and the expansion of existing refineries. NIGC is the employer and the refineries and the transmission companies are customers of this company. To access to the information of refineries, gas stations, and also policies, regulations, procedures, suppliers and equipment of NIGC are the required information of IGEDC. If the organisation's systems connect to the global markets of equipment and technologies for refineries and gas stations, the organisation can design and construct the projects with the lowest price and time with use of the newest technologies.

The Head of HR Training (G3) mentioned that "the alignment is enabling to collect internal information in a knowledge management system and can be linked to the national and international the training centres. Therefore, the internal and external information will be analysed by our experts. Consequently, it helps the organisation to design efficient and effective training courses and recognize the needs of training for the personnel."

Manager of Coordination & Supervisory of Production (G9) described that "the main tasks of this management are planning, management and control of the gas refineries. Thus, it needs to

update the required information about 17 gas refineries at any time. Therefore, an appropriate system was designed by IT companies and the experts of the organisation. The system provides the required knowledge of the gas refineries through connecting to the refineries".

Essential repairs, quality of produced gas, control of energy consumption and fuel wastage are the most important activities of NIORDC (O16). For supervising these activities, two systems help them; the first system provides information of fuel consumption, production and maintenance time of equipment and the second system gives the energy consumption rate. The essential repairs of the refineries are important and vital, because if refineries do not work properly, the fuel cannot reach the power plants on time. Consequently, it can encounter some parts of the country with power shortages. Also, the alignment of KM and e-business strategies is vital when the refineries need to be repaired and also energy consumption and fuel wastage need to be controlled. A professional and technical network includes the experts of each refinery while they receive the information of inside and outside the organisation from stakeholders. It can also plan and sort out different issues in the refineries. For example, when a refinery is being repaired, other refineries can compensate for it in a small period of time. Because the experts will be able to consider all the possible options in order to make appropriate decisions through the alignment.

The main mission of Pars oil and Gas Co. (O10) is to develop joint and non-joint oil and gas fields of the country. There are a lot of projects after exploration of oil and gas fields to design and construction of oil or a gas refinery. Managing, supervising and controlling many projects are difficult without using IT systems, simultaneously. Connecting to experts, managers, contractors, suppliers, world markets of services and commodities, new technologies and methods, multinational oil and gas companies, and regulations, strategies and policies of the organisation can be done effectively and efficiently with use of the web-based advanced systems, which are derived from this alignment. After collecting the required information of the stakeholders, it needs to run meetings to make a decision and solve a problem. The professional and technical networks work separately and some parts are only under the web-based IT systems. A comprehensive web-based IT system needs to consider the comments, ideas and feedbacks of experts, stakeholders, professional and technical forums and networks through aligning KM and e-business systems. The system help to carry out more projects, finding solutions for different problems of development of oil and gas fields before and after handing over to the contractors and end users.

The Planning manager of NIOC (O13) explained that "the exploration and development projects of the oil and gas fields should acquire excellent financial resources, and powerful and

experienced contractors. On the other hand, the Coordination of subsidiaries, regulations, financial resource and contractors are key factors to carry out the projects. This coordination can be managed and supervised by the alignment of KM and e-business strategies when knowledge networked are lunched by web-based systems.

The main activity of Manufacturing Support & Procurement Kala Naft Company (O14) is procurement and purchase of the commodities and raw materials from both internal and external sources and assisting local industrialists and manufacturers. Therefore, the alignment of e-business and KM systems can help to manage and control the process of purchase while the subsidiaries experts can supervise the process and give the required feedbacks and comments. The current system only permits the subsidiary experts to be involved in the first process for filling the relevant forms and the end of the process for handing over the ordered commodities.

The Human Resource (HR) manager of NIOC (O3) stated that "the alignment can assist when the organisation intends to recruit new personnel and to train and promote new and current personnel. NIOC is a big company with many subsidiaries (64 companies) and personnel (280,000 people). Indeed, the company needs a dynamic and alive knowledge network to satisfy the HR requirements for the subsidiaries and headquarters. It is a network which collects comments and ideas via the web which will be analysed by the experts. Also, it needs to coordinate with stakeholders. This is because, the most important suppliers of HR management are the universities and they are not familiar with the training requirements. For example, the universities have trained oil engineers for reservoirs, while the NIOC requires oil engineers for drilling. The alignment can help to coordinate the organisation's requirements with the universities' education programs".

The Head of KM division of NIOC (O5) believes that "the required knowledge is collected from the stakeholder of inside and outside the organisation in a KM system, The interaction between the experts of different divisions and subsidiaries can be enriched KM system thorough internet (web), because it can make effective and efficient networks for responding to environmental changes that impact on the organisation's activities."

Research Institute of Petroleum Industry (O7) has used professional COPs. In fact, they are the knowledge networks to carry out upstream and downstream projects of the oil and gas industry. If the COPs connect to the oil and gas subsidiary companies, the organisation can prevent repetitive projects and use the knowledge of these projects in others. The alignment of KM and e-business can help to achieve this objective.

Conclusion:

The experts (G1, G9, G11, O10, O14 and O16) could describe the relationship the alignment of e-business and KM strategies with stakeholders, and they explained that it can help them to achieve their goals. However, the required infrastructures of technology do not exist or are incomplete. As discussed in the last propositions, the subsidiaries do not have clear strategies for KM and e-business, but some evidence (G1, G3, G12, O10, O14 and O16) demonstrated clearly that there are internal capabilities when the organisation strategies are clear in organisation; because the experts could explain the organisation's situation when KM and e-business strategies are aligned and they could even describe the relationship between the alignment with their stakeholders.

There is an important point here, when the experts explained their situation and did not talk although it is necessary to connect to other parts of the organisation. It shows that there is no strategic view in the organisations. For instance, when HR management (O3) decided to design an e-business system, it did not consider Exploration management (O9) in its system while Exploration management needed HR information to provide the required workforces in its projects. Therefore, the designed e-business and KM systems are one-way; it means that there is no interaction between organisation and stakeholders. They usually receive or send their data and this relationship is not a two-way street.

As a result, there no clear developed and communicated strategies when e-business and KM are aligned in the subsidiaries and if knowledge networks exist, which have been linked to the stakeholder in the subsidiaries, they have not been based on strategic objectives. Therefore, there is no shared platform that can facilitate access to the knowledge.

Proposition 4: e-Enabled knowledge networks will lead the organisation to become knowledge based at individual, organisation and technology levels.

Discussion: The results of this proposition are from the analysis report of Nvivo that have been demonstrated in Table 5-8 and they have been discussed. However, some experts explained how e-enabled knowledge network can assist them in their organisations and that this is related to the last proposition. Therefore, they are explained and then, the changes at three levels are discussed.

The Dispatching manager (G10) believes that "SKADA is a kind of e-enabled knowledge system, because it gathers the required information from distribution companies, refineries, transmission companies, headquarters, power plants and even household and industrial customers; and then this information is analysed by experts. Finally, it transfers them to managers for decision-making. Some information of this system has launched via web-based systems like Weather Forecasting System. Therefore, the best decisions have been made in the shortest possible time. This system is one of the best dispatching systems in the world, because it has been designed and customised by the experts of this management. Trans Canada and Gazprom experts have approved this system, which is one of the best gas transmission systems in the world".

The Planning manager of NIGC (G14) submitted that "e-enabled knowledge network is an amplifier to knowledge management for maximising organisational knowledge. A task of this management is to prepare a short report in maximum 30 minutes after requesting it by managers (usually CEO). The professional teams have access to KM systems to gain organisational information and also the web-based systems to obtain new sciences and technologies in the markets and worlds. Therefore, the experts have used an e-enabled knowledge network to provide the reports. In addition, when experts unexpectedly decide to change a gas pipeline from 6" to 10", an e-enabled knowledge network can help to carry out the project through the knowledge networks of the experts and subsidiaries, and communication with suppliers, contractors and other organisations to the required permits (via web-based systems)".

The HR manager of NIGC (G2) stated that "the information of our divisions collect in a HR system which includes regulations, instructions, procedures, strategies, policies, software, methods and services companies of human resource (HR). On the other hand, the national and international HR services companies; HR suppliers like universities, HR regulations and methods are linked to HR system via internet (web). The e-enabled knowledge network is efficient and effective when HR system has been supported through professional and technical forums and think-tanks. Thus, this e-enabled knowledge network can suggest the best solutions for HR demands."

The Manager of international and commercial affairs (NIGC) (G4) explained that "e-enabled knowledge network can gather knowledge about the current commodities, regulations, policies, strategies, subsidiaries, suppliers, budgets and link to national and international organisations, regulations, markets, suppliers and technologies. Therefore, this is a web-based knowledge management, which supports expert network; because they recognise the internal and external problems in relation to the work and a web-based knowledge system cannot find solutions and

make decision based on their needs. NIGC has no limitations in providing the required systems and infrastructures for an e-enabled knowledge network".

The Manager of R&D of NIGC (G7) explained that "e-enabled knowledge network can help the management when a project is being designed. The most important task of R&D is to determine the research requirements of subsidiaries and to access to the researchers and research centres and resources. Therefore, if the subsidiaries are kept up-to-date with other companies, which have similar projects, it can solve their issues and it would not be necessary to design a new project. Also they can share experiences and select the most appropriate project and reduce the cost. They can even identify that which company and equipment are more appropriate and recognise the advantages and disadvantages of a new technology or methods".

Management of Export and Commercial Affairs (O1) has widespread relationships between the internal divisions of NIOC and external environment, such as oil markets and multinational oil companies. The manger mentioned that "if the management receives the required information from inside and outside the organisation, it can decide and take the best action in the shortest possible time. Informing and analysing the main events of the world, for instance, war, sanction, main oil contracts, contracts of oil and gas equipment and technologies, finding new oil and gas reservoirs, unexpected changes in climates are vital and critical in this work, as these main events strongly effect trading oil and gas and their productions and also it influence period, terms and conditions of their contracts. Consequently, all collected knowledge from inside and outside the organisation by web and KM systems should be analysed in the shortest period by the experts and even other organisation experts such as the ministry of Foreign Affairs."

The HSE manager of NIOC (O2) mentioned that "we have different systems to control and supervise health, safety and the work environment of personnel. On the other hand, we should always prepare for crisis conditions so it can be managed on time and in the best possible way. When KM systems connect to the organisation's stakeholders through the web, this web-based knowledge management system can improve the decisions making process. Thus, the organisation has enriched KM networks to communicate and transfer the feedbacks, comments and ideas about a particular decisions and actions. Web-based knowledge systems that have not been enriched by the comments and feedbacks from the stakeholders have higher chances of failing in the future."

The main activities of Technology management (O12) are to find the best new methods and technologies for the subsidiaries in explorations, drilling, refineries, constructions, gas and oil stations, pipelines, distributions, and also to check the prices, suppliers, political conditions and replacement methods and technologies when the subsidiaries intend to use a new methods or

technologies. The manager believes that e-enabled knowledge networks exists in their management; because some professional teams, which include the experts of the management and the subsidiaries, supervise and control the whole selection process of the method or technology from an idea till buying and applying them. The less experienced and unskilled experts are the main barrier in this process, because they do not properly recognise the world markets or English language for an efficient and effective communication with the suppliers of equipment and services."

The NIOPDC manager (O15) discussed that "Smart fuel system is an enabled knowledge network, because the stakeholders have been connected to this system and they can give their comments and feedbacks, thus the experts can continuously modify the system and solve the customers' problems in the shortest possible time. The main barrier is lack of appropriate infrastructure of technology. Many cities do not have the required infrastructure to use internet and set up the required equipment."

The system is one of the greatest and unique IT projects in the world, financed and commissioned by NIPDC during recent years. The system developed by local experts in 2010, provides services to over 23,281,794 subscribers, gathers vehicles fuelling data from 3000 fuel stations all over the country through benefitting from a mechanised system, and transmits the data to one of the biggest data centres for processing, so that the required analytic and statistical reports would be prepared on this basis. Over 1200 support offices throughout the country offer services to fuel smart card subscribers and users. Over the recent years, the implementation of fuel smart card project has not only controlled the growing trend of oil products' consumption but has also reduced petrol and diesel consumption rate, so that over $22 billion has been saved through reducing petrol and diesel import.

The mission of IOPTC (O17) is the maintenance of sustainable, safe and economic exploitation of the pipeline and transferring petroleum through the support of industrial telecommunication network. Thus, they use different KM and e-business systems. The manager explained that "the most important usage of e-enabled knowledge network is when the main repairs begin. This process needs to be planned, decided and run through numerous meetings. The company should provide the required equipment, commodities and technical services from the variety of suppliers. Therefore, e-enabled knowledge networks can quickly access the suppliers. This leads to carrying out the projects at the best quality and in a time efficient manner"

The responsibility of the oil refineries management is NIORDC (O16). They use different IT systems, which have not been linked together. Professional teams supervise and control the refinery process. The purchase system of commodity and the distribution systems are

completely separate from other systems. Some systems are smart and web-based but are only for a certain division and have not been linked. The main factor for separating the systems is that the management changes continuously. The managers are usually selected politically and they do not consider organisational objectives and strategies. Some managers believe in IT and web-based systems, but some do not."

The Institute for International Energy Studies (IIES) (O4) is a research centre. The manager stated that "the research divisions have relationships with research centres and companies oil and gas industry; but there is a gap between IIES and the oil and gas companies of NIOC. The routine activity of IIES is to contract the oil and gas companies to carry out projects. Also the institute researchers find new methods and technologies, and then they contract other oil and gas companies. Unfortunately, the researchers do not get familiar with the processes and equipment of the oil and gas companies. Furthermore, the experts of the oil and gas companies are not informed about the new technologies or methods, which have been used within the international oil and gas research centres. Therefore, some projects fail. The e-enabled knowledge network can assist to build a widespread network between the institute researchers, and the experts of oil and gas research centres. This network has high efficiency and productivity, because experts and researchers consider the existing requirements for using a new method or technology. As a result, the institute can efficiently and effectively carry out more projects with lower cost and in shorter time."

The R&D manager of NIOC (O6) believes that there is an e-enabled knowledge network in their organisation. The manager explained that "we use a web-based portal of project management that is available for managers, experts, researchers and students of subsidiaries, universities and research centres. Also, we have professional and technical meetings for sharing experiences and solving problems. Therefore, the portal and the professional expert panels have a perfect interaction in the organisation. An example of this interaction is to design a "drilling bit", which can be used to drill oil and gas fields. Production of this equipment internally can help to reduce the cost of projects considerably, while NIOC has to buy a drilling bit from the international market at triple the cost."

The Exploration manager of NIOC (O9) mentioned that "we use EPM (Enterprise Project Management) software to manage and control our projects. The projects are managed and controlled by managers, experts, contractors and suppliers through EPM. Managers control the project progress to decide budget and time and check the physical progress. Also, the experts supervise and control the project issues. The contractors use EPM to solve technical problems of the projects and the suppliers use it to provide the required equipment and commodities.

Therefore, EPM is an e-enabled knowledge network and a comprehensive system. We invited representatives of the divisions and contractors when the organisation intended to design EPM. The experts considered different professional systems of project management and studied their advantages and disadvantages. They even spoke with multinational oil and gas experts for designing EPM. Therefore, this software covers the requirements of the projects and activities. The e-enabled knowledge network can help to select the projects, to drill oil and gas field and to reduce the risk of projects."

Table 5-8 is from the analysis reports of Nvivo and demonstrates that the changes should be done in individuals, organisation and technology levels by e-enabled knowledge network when organisations attempt to transfer to a KBO. Some of them are explained briefly.

Levels	Comments	Subsidiaries
Organisation	• To update knowledge of the experts and bench marking	O13
	• To facilitate knowledge communication between organisation and stakeholders	G2
	• To change vertical and complicated structure to a flat and simple structure and in some cases project-oriented	O5
	• To formulate strategic document (vision, mission, strategies, objectives, etc.) with corporation of personnel as it has been clarified and simplified (not complicated)	O17 O8
	• To formulate KM and e-business strategies with accordance to strategic document with corporation of personnel	G2
	• To recruit and use experienced and skilful managers and experts in the specific and key positions	O9 G13
	• To have motivation programs to share knowledge between personnel	
	• To form professional COPs and knowledge networks that are including the experts and managers and relevant subsidiaries (like committees and expert panels)	O2
	• To design applications and systems with corporation of personnel for communication with stakeholders	G12
	• To force managers, experts, personnel and stakeholders in use of IT and web-based systems (KM and e-business)	G1
	• To formulate and simplify the specific regulation, design and integrate IT systems and to share knowledge	G8
Technology	• To corporate oil and gas companies with IT companies to design and	O7

	develop oil and gas industry applications	
	• To increase security of IT system to prevent hackers attacks	O14
	• To benchmark e-business and KM systems and best practises in oil and gas industry and also design and use of them in the organisation	G5
	• To provide the required equipment and applications to integrate the current KM and e-business systems	O1
Individual	• To increase rate of team work and knowledge sharing	G11
	• To recognise and use the current IT and web-based systems	G9
	• To enhance skills of people	O16

Table 5-8: the changes, which should be done in three levels that organisation can be transferred a KBO by e-enabled knowledge network

The Manager of IOPTC (O17) believes that an e-enabled knowledge network should change how the company formulates the strategic documents of the organisation. It should make a knowledge network that personnel can be involved in the formulation of vision, mission, strategies and objectives of their organisation.

The Planning manager of NIOC (O13) explained that "e-enabled knowledge network updates knowledge of the experts and bench marking". HR manager of NIGC (G2) discussed that "e-enabled knowledge network can change the organisation in:

❖ Updating the employees with the required knowledge

❖ Facilitating knowledge communication between the employees

❖ Facilitating knowledge communication between the organisation and stakeholders

❖ Time and cost efficient

The Manager of RIPI (O7) mentioned that "e-enabled knowledge network creates a knowledge network between IT designer and the organisation experts and that it results in the design and purchase of efficient systems and equipment."

Conclusion

The most important use of e-enabled knowledge network is when managers or experts intend to decide in the shortest possible time. The subsidiaries which have e-enabled knowledge networks are HR (O3 and G2) Exploration (O9) Dispatching (G10), NIOPDC (O15) and Management of

coordination and supervisory (G9). Below are the advantages of e-enabled knowledge networks in the oil and gas industry:

- Accessing the market information, e.g. new energies (solar, hybrid, etc.), new technologies, new productions, etc.

- Informing about political events, such as signing a contract between countries (for instance building a gas pipeline), sanction and war on oil-producing countries

- Carrying out a higher number of projects through using experiences of other projects while they are being updated by e-enabled knowledge network

- Recognising the most appropriate experts to carry out the projects through an e-enabled knowledge network

- Applying the most efficient and effective technologies through adapting existing knowledge and available knowledge on the internet as well as knowledge which has been customised by experts. This work is run by an e-enabled knowledge network, therefore the most appropriate and newest technologies in the implementation of their project are produced

- The e-enabled knowledge network helps them to predict when unexpected problem occur in their project and they should have immediate access to a great deal of information from the internal divisions and external environment of their organisation.

- There is a direct relationship between the skills of a manager and implementation of e-business and KM systems. The managers who know their work well, are familiar with systems and applications, dedicate some of their free time to updating themselves by accessing the internet, they have an efficient and effective system for doing their tasks, activities and processes.

The results of this proposition have been divided into two parts. The Frist part demonstrated that there are the subsidiaries that could make e-enabled knowledge network in their organisation for instances: SKADA (G10) and Smart Fuel System (O15). However, these e-enabled knowledge networks have not been made based on developed and communicated strategies that are clear for all employees. They are usually made accidently, but internal capabilities like abilities of managers and experts have a key role here. As mentioned before, skilful and experienced managers and experts could make efficient and effective systems while they are sanctioned and in an oil-based country.

The second part mentions how e-enabled knowledge networks transform organisations to become knowledge-based organisations at individual, technology and organisation levels. As mentioned specially in table 5-8, many of the changes are related to barriers that were explained for e-business and KM systems. Knowledge networks and the web are the main factors in creating resources and the flow of knowledge in the organisation for having a knowledge-based organisation. Therefore, e-enabled knowledge network can resolve the barriers to making knowledge networks and communications.

Propositions 5 and 6

- ➢ **e-Enabled knowledge networks will lead to sustained strategic capabilities in the organisation:**
  - To create value and exploit market opportunities

  - To respond to market and environment changes in an agile manner

  - To become a learning organisation

  - Increase of organisational absorptive capacity

  - To become an innovation led organisation

  - Increased rate of new product development and introduction

  - To become resilient to unexpected changes (threats and crisis)

- ➢ **e-Enabled knowledge networks will lead to improved and sustained efficiency and performance of the organisation:**
  - Increase customers satisfaction

  - Meet and exceed market share

  - Increased sales and profit

  - Reduced cost of operations

  - Reduced time of operations

Discussion: A country with an oil-based economy produces oil and gas with high quality, continuously so that it can sell them to gain more income. Therefore, the oil and gas industry of such countries concentrates their activities on exploration of new oil and gas fields, development and maintenance of the current oil and gas fields. Thus, they need to carry out projects in order to meet their objectives. The core of the projects is human resources (HR) and equipment. Cost and time are two key factors in carrying out the projects. If the oil and gas companies employ human resources and/or equipment inappropriately, it can increase the cost and/or the time of the projects, and even lead to a failure.

Tables 5-9 and 5-10 demonstrate how e-enabled knowledge networks can influence the strategic capabilities and the organisational performance in the subsidiaries. The explanations of the experts about the concepts of strategic capabilities (Absorptive capacity, organisational learning, agility, innovation and resilience) and organisational performance (cost and time of operations and customer satisfaction) are based on their organisational approach to the definitions of the concepts. Therefore, the explanations may not be comprehensive.

SBUs/ Companies	System	Strategic Capabilities
HSE (G1)	HSE system	**Absorptive capacity:** • Knowledge networks • Professional committees **Agility:** • Assess and review the methods and programs in health & safety and environment **Innovation:** • Design an integrated system for providing and maintaining the required training and identifying, assessing, eliminating and/or controlling effectively the potential hazards under normal, changing and critical conditions **Resilience:** • Retain the health and safety of personnel and equipment with respects to the shortage of skilful workforces and expensive equipment • Optimisation of energy use and resources, thus minimising wastes and pollutants
International and Commercial Affairs (G4)	**Purchase management system**	**Absorptive capacity:** • Technical forums • Expert panels **Agility:** • Prevent re-buy of the commodities and equipment **Innovation:** • Design a system to manage the organisation purchase for the required commodities and equipment **Resilience:** • Save financial source while the organisation has sanction on some

		commodities
Coordination and Supervisory of Production (G9)	**Refinery management system**	**Absorptive capacity:** • Knowledge networks • Technical forums **Agility:** • Manage and control repairs of gas pipelines **Innovation:** • Video conference system **Resilience:** • Prevent the cut of gas flow in the country
Dispatching (G10)	**SKADA**	**Absorptive capacity:** • Technical forums • Expert panels **Agility:** • Unique application **Innovation:** • Design a new system which is a best practice in the world **Resilience:** • Prevent gas flow cut off when three gas pipelines exploded
Distribution (G11)	**Distribution system**	**Absorptive capacity:** • Customer suggestion system • Expert panels • Professional networks **Agility:** • Reduce lost gases **Innovation:** • Intelligent gas counter reading **Resilience:** • Reduce the cut of gas flow
Planning (O13)	**Planning system**	**Absorptive capacity:** • Knowledge networks • Professional forums **Agility:** • Change vertical structure to matrix and flat structure **Innovation:** • Design a new system **Resilience:** • Achieve opportunities and avoid threats to the internal and external environment via reports to managers and stakeholders
Export and International Affairs (O1)	**Website**	**Absorptive capacity:** • Professional teams • Knowledge networks **Agility:** • Design a flat and flexible structure **Innovation:**

		• Design a new software and organisational structure **Resilience:** • Control and view markets in respects to oil and gas industry
HR (O3)	**Website (e-Org)**	**Absorptive capacity:** • Professional committees • Knowledge networks **Agility:** • Adapt HR requirements of the organisation with HR market **Innovation:** • Design a system (includes elite recruitment, suggestion, training, etc.) • Establish new universities, schools and fields for oil and gas **Resilience:** • Supply the required workforces
R&D (O6)	**Project management system**	**Absorptive capacity:** • Think-tanks • Professional forums • Technical committees **Agility:** • Change vertical structure to flat structure **Innovation:** • Design an application to control the projects processes **Resilience:** • Reduce repetitive projects
Exploration (O9)	**EPM**	**Absorptive capacity:** • Knowledge networks • Expert panels • Technical committees **Agility:** • Response to the company demands **Innovation:** • Design a new drilling bit • Find new market for new product **Resilience:** • Ignore sanctions impacts
NIOPDC (O15)	**Smart fuel system**	**Absorptive capacity:** • Customers suggestions system • Government supervisory system • Professional committees **Agility:** • A solution for nullifying sanctions impacts on fuel imports **Innovation:** • Design a new and unique system in the world **Resilience:** • Control irregular consumption of fuel

Table 5-9: Some outcomes of e-enabled knowledge network on strategic capabilities

The HSE system of NIGC (G1) has been connected to the subsidiaries. They have made some professional committees for crisis management and common issues in health, safety and environment. The committees are active when an unexpected issue occurs in the organisation. The members of the committees are both internal and external of the organisation and even out of the oil and gas industry that is related to the occurred issues. However, knowledge networks work continuously, they have regular meetings to communicate and share knowledge of the subsidiaries with the head office. The HSE system is also connected to knowledge networks and professional committees and they can create and share new knowledge in HSE management.

The regulations, methods and programs of HSE are constantly changing and developing. The HSE system can quickly access and review them in the external environment and adapt and change them in the organisation and the subsidiaries. The Design of an integrated system can provide and maintain the required training and also it can identify, assess, eliminate and/or successfully control the possible dangers subject to standard, fluctuating and life-threatening circumstances, it needs to combine the subsidiaries and relevant external organisations with HSE management.

The retention of HSE personnel and equipment are vital in the organisation with respect to the shortage of skilful workforces and expensive equipment in the oil and gas industry that is sanctioned. Also, it is essential to optimise the consumption of energy and resources, and minimise wastes and pollutants. The HSE system can increase knowledge flow via the integration of HSE systems of the subsidiaries with the acquired knowledge of the professional committees and knowledge networks. The HSE system can reduce number of incidents annually from 140 cases to 65 cases and also the number of health and environmental complaints have been reduced from 26 cases to 12 cases annually.

The Purchase management system of international and commercial affairs (G4) attains the knowledge networks and experts panels. The design of this system has prevented the re-purchasing of the commodities and equipment and saved financial sources while the organisation is sanctioned on some commodities and equipment. The system could reduce the purchase costs of commodities and equipment by 35 % annually and reduce the order delivery time from 6 to 2 weeks.

SBUs/ Companies	System	Organisation Performance
HSE (G1)	HSE system	• Reduce number of incidents from 140 to 65 cases/year) • Reduce number of complaints (environmental and health) from 26 to 12 cases
International	Purchase	• Reduce the purchase costs of commodities and equipment by 30 %

	management system	• Reduce the time of order to receive point from 6 to 2 weeks
and Commercial Affairs (G4)		
Coordination and Supervisory of Production (G9)	Refinery management system	• Reduce the repairs time from 8 to 5 weeks • Reduce the traveling costs £80,000 to £10,000 (per year) • Reduce the time of decision making from 10 to less than 2 day
Dispatching (G10)	SKADA	• Disconnection of gas supply in the country • Reduce repairs times from 12 to 8 weeks • Reduce cut gas flow twice in a month to zero (exception strong cold temperature)
Distribution (G11)	Distribution system	• Reduce the lost gas by 60 % • Reduce the cost of gas counter reading by 80 % • Reduce attend of customers to the gas offices by 65 %
Planning (O13)	Planning system	• Reduce time of response to managers from 3 hours to 30 minutes
Export and International Affairs (O1)	Website	• Reduce number of personnel by 20 % • Increase rate of useful information by 35 %
HR (O3)	Website (e-Org)	• Increase number of suggestions from 300 to over 2000 per year • Save financial resources by 28 % • Reduce transfer of employees abroad from 40 to less than 5 people per year • Increase the fields of oil engineering in the country from zero to 2 petroleum universities, 8 oil engineering schools and over 15 petroleum institutes and research centres
R&D (O6)	Project management system	• Remove repetitive projects resulting in reduce number of projects from 185 to 121 projects per year • Reduce the costs of projects from £500,000 to £300,000 per year • Check and view the project situation wherever and whenever by stakeholders
Exploration (O9)	EPM	• Reduce supply period from 3 months to 2 weeks • New product price £5,600 (£10,000 with sanction) to £3,300
NIOPDC (O15)	Smart fuel system	• Petrol consumption: 95 million litre/day with 15 million vehicles, reduced to 75 million litre/day with 25 million vehicles • Decrease the time of decision to action points from 3 months to 2 days • Customers satisfaction due to fuel costs payment with debit card instead of cash

Table 5-10: Some outcomes of e-enabled knowledge network on organisation performance

The management of coordination and supervisory of production (G9) uses a refinery management system. The system is connected to some knowledge networks and technical forums. The key point of the system is the video conference system. They could run their meetings via video conference. The refinery management system manages and controls the repairs of the gas pipelines. The collaboration of this management and dispatching management could prevent to cut the gas flows in the country. The system has reduced the repair time from 8 to 5 weeks and the travelling cost £80,000 to £10,000, annually. Also, the process time of decision-making has reduced from 10 to less than 2 days.

Dispatching management (G10) uses the SKADA system. The system is an advanced and unique system of gas transmission in the world. There was no system comparable to this when it was designed. This is because Iran has the largest number of gas pipelines in the world and it

was necessary to design a unique system. Experts of Trans Canada and Gazprom (oil and gas companies) approved that this system is a best practice in the world. It could circumvent cutting the gas flow when saboteurs explode three gas pipelines simultaneously. It could also reduce the repairs time from 12 to 5 weeks and reduce disconnection of gas flow from twice in month to zero (exception strong cold temperature).

The system of distribution management (G11) is connected to professional networks, expert panels and customer suggestion systems. This system could reduce the lost gas and prevent the disconnection of gas flow in the cities. Also, the management has designed an intelligent gas counter reading, which is enabled to read a gas counter without attending a gas counter reader. This system controls the gas flow from the main gas pipelines to the consumption point. Therefore, it could reduce the lost gas by 60 % and the cost of gas counter reading by 80 %, annually. Also it reduced the number of customer attendance to the gas offices by 65 %.

One of the most important tasks of planning management (O13) is to decide and plan when an unexpected issue occurs in the organisation. The system of planning helps to increase the speed of planning and decision-making, because it is connected to knowledge networks and professional forums. Also they have changed the vertical structure to a flat and horizontal structure. Therefore, they can achieve opportunities and avoid threats of internal and external organisations and also report to managers and stakeholders in the shortest possible time. The response time between managers and stakeholders has reduced from 3 hours to 30 minutes via the planning system.

Export and international affairs (O1) use a system, which is linked to professional teams and knowledge networks. They designed a system to control and view the situation of the oil and gas market in the world. The efficiency of the system was increased when they changed the organisational structure to a flat structure. The system resulted in the drawing up of a contract during the better conditions. Also, it is not necessary for the managers and experts to attempt to view and control the markets in the office; this caused them to reduce number of personnel by 20%. Also, the rate of useful information increased by 35% in the organisation, annually.

The HR management (O3) has designed a comprehensive system which includes several sub-systems. The system has been integrated into sub-systems and connected to professional committees and knowledge networks. It adapts the HR requirements of the organisation with HR markets. The different parts of this are including elite recruitment, suggestion system, training, etc. The management could identify some of the requirements of the organisation that the market cannot satisfy them. Therefore, they have established some new universities, schools and academic fields for oil and gas, because they need to supply skilful workforces familiar

with oil and gas industry. The system helped to increase the fields of oil engineering in the country from zero to 2 petroleum universities, 8 oil engineering schools and over 15 petroleum institutes and research centres. Also it has reduced to transfer skilful workforces abroad for educational purposes from 40 to less 5 people per year. The suggestion management of this system has increased the number of suggestions from 300 to over 2000 annually so that it saves financial resources by almost 28%.

The Project management system of R&D (O6) is connected to think-tanks, professional forums and technical committees. The system has also decreased the number of personnel in this management and changed it to a flat structure. This system can control the whole processes of the projects from their start to end points. It removed the repetitive projects and the number of the projects reduced from 185 to 121 projects per year. Additionally, the number of projects' processes has been reduced as well. Consequently, the costs of projects have decreased from £500,000 to £300,000 per year. The satisfaction of the stakeholders has increased, because they can check and review the project situation at any time.

EPM is system of Exploration management (O9) that was designed by the experts of this management. They can change and add different parts to this system when the organisation has faced opportunities or threats from external and internal environments through different knowledge networks, expert panels and technical committees. The experts could design a "drilling bit" with the help of the knowledge acquired from this system while the organisation is sanctioned to buy some commodities like drilling bits. They could even find markets for it and ignore sanction impacts. The price of a drilling bit is £5,600 (with the sanction it is approximately £10,000) while the designed drilling bit is approximately £3,300. Also, this system was caused to reduce the supply period for commodities and equipment from 3 months to 2 weeks.

The Smart fuel system of NIOPDC (O15) is also a unique system to control fuel consumption in the world. The system is connected to the customer suggestion system, government supervisory system and professional committees. This system is a solution for nullifying sanctions impacts on fuel imports and the controlled irregular consumption of fuel. The designed system could reduce petrol consumption from 95 million litters/day with 15 million vehicles in 2006 to 75 million litters/day with 25 million vehicles in 2014. The customer satisfaction has increased because they can pay the fuel cost with their Smart Fuel Card, which is connected to their bank accounts. Also, the system could decrease the time of decision to action points from 3 months to 2 days in NIOPDC.

Conclusion

In this part, some evidence demonstrates how when e-business and KM strategies have been integrated and communicated properly and e-enabled knowledge networks are created with the help of knowledge networks, the network can have an impact on the strategic capabilities and organisational performance. As mentioned, this network led to producing a drilling bit in the Exploration management of NIOC, even though this company is sanctioned. This evidence can clarify that the network can create value and exploit new markets, reduce the time and cost of the operations as well as the innovation and resilience in the organisation. Other evidences could have clarified e-enabled knowledge network can impact on the rest of concepts in the strategic capabilities and the organisational performance.

A Cross-Case Analysis between the NIOC and NIGC Subsidiaries

The results of the propositions demonstrated each subsidiary's situation in e-business and KM systems and how e-enabled knowledge network effects on its internal competencies, strategic capabilities and organisation performance. This part is a cross case analysis between the subsidiaries of NIOC and NIGC.

As mentioned in the fourth chapter, the NIOC and NIGC subsidiaries fitted into four categories based on the Bain model; EDP (exploration, development and production), investment, supply chain and business and marketing. Table 5-11 shows the outstanding features of e-business systems of NIOC and NIGC subsidiaries in the Bain model. Each category is discussed in this part, separately.

In EDP category, while NIGC does not work in exploration, but the Exploration Management of NIOC (O9) could use the appropriate e-business systems to explore and develop the oil and gas fields. As discussed previously, the experts of this management bought and customised the required applications such as Enterprise Project Management (EPM). In production of the oil and gas, Pars Oil and Gas Company (O10) is using a project management system, which designed and customised with cooperation from Total Company (a French oil company). On the other hand, the Management of Coordination and Supervisory of Production of NIGC (G9) could manage and plan the gas production with a refinery management system and to have meetings via videoconference between 13 gas refineries throughout the country. SKADA system of Dispatching Management of NIGC (G10) is a best practice in the gas transmission, which can be a pattern for NIOC in the oil transmission. But, National Iranian Oil Refinery and Distribution Company (O15) has designed a Smart Fuel System, which is a best practice, as well. It can be a gas distribution model for NIGC. In distribution, both NIOC and NIGC

subsidiaries have a weak interaction with their customers. While Distribution Management of NIGC (G11), NIORDC (O15), NIOPDC (O16) and IOPTC (O17) have customer relationship management system and transformation payment systems for satisfying their customers.

In investment category, the Planning Management is only subsidiary in this category. This management is like a brain for the oil and gas companies. This is because, all information of the organisation should be analysed and processed by this management, which can help managers and experts to make decision and perform their tasks. The Planning Management of both companies (O13 and G14) are working traditionally, while they are using some systems to manage and control projects and have advice to the managers and experts. The systems are incomplete and unintegrated with other systems.

The managements of International and Commercial Affairs are in supply chain category. The managements (O1, O14 and G4) have a constructive interaction together and could design a comprehensive system for purchase and inventory management. While the systems are linked to internal departments and some external stakeholders like providers and customers, however, unfortunately, the systems are also uncompleted and unintegrated. The management should involve many relevant subsidiaries and consider more stakeholders during designing and planning for their systems.

In business and marketing category, the HSE managements of NIOC and NIGC (O2 and G1) have different strategies to design and use e-business systems. HSE management of NIGC (G1) have focused on training and incidents analysis systems, while HSE management of NIOC (O2) have considered risk management. Their systems have complete separate performance, while integration of the systems can assist them in doing their activities. HR managements of NIOC and NIGC (O3 and G2) have communicated together in designing systems and planning activities. The results of this outstanding cooperation are an internal system for planning and interacting with personnel (e-Org) and comprehensive integrated recruitment system. This cooperation has been observable in their Training (G3) and KM divisions (O5 and G5), as it has led to some system like e-Learning, e-Library and Comprehensive KM management. But, HR management of NIOC (O3) have implemented a system to connect with the government. Therefore, they should develop their collaboration in external organisation activities, as they have a constructive communication in the internal organisation activities. The Structure Managements of NIOC and NIGC (O8 and G8) are utilising documentation management system and e-shared sources. The systems in use are out-of-date and need to be re-designed with respects to their activities. The NIOC have had a considerable improvement in R&D activities and e-business systems. NIOC's R&D activities have been divided into three subsidiaries,

exploration, development and production in Research Institute of Petroleum Industry (O7), economic energy and HR planning in Institute for International Energy Studies (O4) and finally, management, planning and organisation of all R&D projects and activities in R&D management (O6), while all R&D activities of NIGC have been accumulated in a subsidiary (G7) with insufficient personnel. Nevertheless, project management systems have been designed, but they are incomplete and unintegrated in the R&D subsidiaries of NIOC and NIGC and need to be developed and re-designed with respects to their activities and processes.

Bain Model's Category	NIOC	NIGC
EDP	**O9:** Enterprise Project Management (EPM), Upstream data system **O10:** Project management system **O11:** e-Auction **O15:** Smart fuel system **O16:** Tanks Automatic Gauging System **O17:** Payment system for transportation of the four main products	**G9:** Refinery management system, Video Conference **G10:** SKADA system, Weather forecasting system **G11:** Customer relationship management (CRM system) **G12:** Statistic and report system, Project management system **G13:** Inventory management system
Investment	**O13:** Control project system, Upstream data system	**G14:** Project assessment system
Supply Chain	**O1:** Trade and management oil and gas via website **O14:** Purchase management system	**G4:** Purchase management system
Business and Marketing	**O2:** Risk management system of projects **O3:** e-Org, Government messaging system **O4:** Introducing new projects via website **O5:** Comprehensive KM system **O6:** Project management system **O7:** Project management system **O8:** Documentation management system	**G1:** HSE training system, Incident analysis system **G2:** Elite recruitment system, Feedback and suggestion system **G3:** HR training system **G5:** Comprehensive KM system, Project management system **G7:** Expert analysis system **G8:** e-shared resources of structure management

Table 5-11: The outstanding features of e-business systems of NIOC and NIGC subsidiaries in the Bain model

The next cross-case analysis between NIOC and NIGC is related to KM systems. The subsidiaries of some KM systems have been placed into the Bain model's category in Tables 5-12. As mentioned previously, the main missions of Exploration management (O9) and Pars Oil and Gas Company (O10) are exploration, development and production of the oil and gas fields. Therefore, their KM systems have focused on project management systems and Lesson Learned projects. The subsidiaries have been almost successful. On the other hand, the management of Exploration is utilising Share Point application, which is a best knowledge sharing application in the world and even some multinational companies such as BP is using the application. The management of Coordination and Supervisory of Production of NIGC (G9) have designed and

utilised a refinery management system, which can control and manage the required information of 13 refineries in the system of head office, simultaneously. It should be noted that KM systems of O9, O10 and G9 need to develop and integrate to other systems in their organisations. The NIGC subsidiaries in EDP category like the management of Distribution (G11), Iranian Gas Engineering and Development Company (G12) and Iranian Gas Transmission Company (G13) could make professional COPs and technical panels for sharing knowledge, while the NIOC subsidiaries are instead more laid on the systems like e-Org (O10), e-Auction (O11) and Barid (O12). The Dispatching Management of NIGC (G10) have utilised two KM systems, which help their e-business system (SKADA). They include Decision Support system and Network Optimising system. While National Iranian Oil Production Distribution Company (O15) have been successful in e-business system (Smart Fuel system), but it could not build professional and technical knowledge networks via COPs and forums. It shows that the NIOC subsidiaries are not able to make communication between their experts. This issue refers back to their problems in the organisational culture, which has been discussed previously.

The issue is completely visible again when the planning managements of NIOC (O13) and NIGC (G14) are compared in investment category. The Planning management of NIGC (G14) are utilising professional COPs with their systems, while the Planning management of NIOC has only used some KM systems such as project control system and Upstream information system. Appropriate KM systems for NIGC and knowledge networks such as technical expert panels and professional COPs for NIOC can improve their organisation performance effectively and efficiently.

The International and Commercial Affairs of NIOC and NIGC (O1, O14 and G4) have similar performances in use of the e-business systems. As explained in the last parts, a purchasing management system and inventory management system have been designed in a collaboration (NIOC and NIGC experts), while they are incomplete and unintegrated. They did not consider many stakeholders when the system was being designed. Lack of KM methods is visible in these subsidiaries like COPs, knowledge networks, etc.

In business and marketing category, three popular KM methods are observable in the HR managements (O3 and G2) and KM divisions (G5 and O5), which include comprehensive KM systems and knowledge acquisition systems. When the two systems were designed that many managers and experts of NIOC and NIGC were retiring or leaving their organisations; therefore, it was necessary for their knowledge to be transferred to the current and new personnel or stored in KM systems. Consequently, the NIOC and NIGC managers decided to design and implement the mentioned KM systems. Both systems were faced to fail, because their managers imagined

that KM is only an application that people just fill in its different parts. O3, G2, O5 and G5 collaborated in design of their KM systems. This belief that KM is only an application is in the Structure managements of NIOC and NIGC (O8 and G8). The high volume of data exists in two managements and they attempted to manage their activities through implementation of documentation management system. They have understood that the systems do not satisfy their requirements and started to form Think-tanks (O8) and professional networks (G8).

Bain Model's Category	NIOC	NIGC
EDP	**O9:** Lesson Learned projects (KA), Share point system (KD), Enterprise project system (KU) **O10:** e-Org (KA) **O11:** e-Auction (KD) **O12:** Barid (KA) **O15:** Smart fuel system (KU) **O16:** Dispatching system (KU) **O17:** Transportation payment system (KU)	**G9:** Refinery management system (KU) **G10:** Network optimising system (KD), Decision support system (KU) **G11:** COPs (KA) **G12:** COPs (KA), Method formulation committees (KA), Knowledge exchange panel (KD) **G13:** Documentation management system (KD)
Investment	**O13:** Control Project System (ECPM) (KU), Upstream information system (KU)	**G14:** Professional COPs (KA)
Supply Chain	**O1:** Administrative automation (KA) **O14:** Purchase management system (KU)	**G4:** Purchase management system (KU)
Business and Marketing	**O2:** Risk management system (KD), HSE performance management (KU) **O3:** HR knowledge networks (KA) **O4:** Documentation management system (KD), Project management system (KU) **O5:** Knowledge Acquisition system (KA), Comprehensive KM system (KU) **O6:** Barid (KA), Professional panels (KD) **O7:** COPs (KA), KM systems (KD) **O8:** Think thanks (KA)	**G1:** e-Org (KA) **G2:** Comprehensive KM system (KU), Knowledge Acquisition system (KA) **G3:** e-Learning, e-Library and e-Training (KA), Training system (KU) **G5:** KM system (KD) **G6:** Barid (KA) **G7:** Professional Forums (KA) **G8:** Documentation management system (KD), Professional networks (KA)

Table 5-12: The outstanding features of KM systems of NIOC and NIGC subsidiaries in the Bain model

The next cross-case analysis is about the internal competencies between NIOC and NIGC subsidiaries. According to the research model, the successful adoption of knowledge management and e-business systems when e-enabled knowledge network is implemented, requires the development of the internal competencies. Three dimensions of internal competencies are identified in an organisation that facilitates the adoption of knowledge management and e-business systems including: organisation, technology and individual (Chaston and Mangles, 2002; Fiers and Williams 2003). In EDP category, as Table 5-13 shows the required changes are related to organisation and individual in the NIOC and NIGC subsidiaries. The required changes of the Exploration management (O9) is related to

organisational culture, Iran Oil Pipelines and Telecommunication Company (O17) refers to organisational structure and National Iranian Oil Refinery and Distribution Company (O16) is connected to personality of individual. On the other hand, the required changes, which should be done in the subsidiaries of NIGC include, Management of Coordination and Supervisory of Production (G9) in awareness of individual, Management of Distribution (G11) in trust of individual, Iranian Gas Engineering and Development Company (G12) in organisational structure and Iranian Gas Transmission Company (G13) in organisational culture. Therefore, the required changes of the EDP category are related to organisation and individual levels. It shows that the main requirements of the subsidiaries are not in tools and infrastructure of technology.

In investment category, Planning Management of NIOC (O13) explained that their required change is associate with updating knowledge of the experts and benchmarking the best practices for using it in their organisation and this is an organisational culture, while the Planning Management of NIGC (G14) could solve this issue by utilisation of the appropriate mechanisms.

In supply chain category, Management of Export and International Affairs (O1) refers to the required equipment and applications to integrate the current KM and e-business systems as the tools of technology. The Manufacturing Support and Procurement Kala Naft Company (O14) explains that the security of IT system should be increased to prevent hackers' attacks as the changes should be done in both tools and infrastructure of technology in their organisations. In contrast, Management of International and Commercial Affairs of NIGC (G4) has provided the required tools and infrastructure.

In business and marketing category, the NIOC and NIGC subsidiaries explained that the required changed should be done in organisation and technology levels. HSE management (O2) and KM division (O5) of NIOC, HSE management (G1), HR management (G2), Structure management (G8) of NIGC refers that the changes should be done in organisational culture. On the other hand, Research Institute of Petroleum Industry (O7) and KM division of NIGC (G5) mentioned that the changes should be focused on tools of technology, but the Structure management of NIOC (O8) emphasises on organisational structure.

Generally, the results demonstrate that the organisational culture is a main factor when an organisation wants to transfer to a KBO through e-enabled knowledge network. In the last part, the results shown that there is lack of professional forums, technical panels and knowledge networks, which is possible to be rooted in the organisational culture.

Bain Model's Category	NIOC	NIGC
EDP	**O9:** To recruit and use experienced and skilful managers and experts in the specific and key positions (Organisation, Culture) **O16:** To enhance skills of people (Individual, Personality) **O17:** To formulate strategic document (vision, mission, strategies, objectives, etc.) with corporation of personnel as it has been clarified and simplified (not complicated) (Organisation, Structure)	**G9:** To recognise and use the current IT and web-based systems (Individual, Awareness) **G11:** To increase rate of team work and knowledge sharing (Individual, Trust) **G12:** To design applications and systems with corporation of personnel for communication with stakeholders (Organisation, Structure) **G13:** To have motivation programs to share knowledge between personnel (Organisation, Work process)
Investment	**O13:** To update knowledge of the experts and bench marking (Organisation, Culture)	---
Supply Chain	**O1:** To provide the required equipment and applications to integrate the current KM and e-business systems (technology, tools) **O14:** To increase security of IT system to prevent hackers attacks (technology, tools and infrastructure)	---
Business and Marketing	**O2:** To form professional COPs and knowledge networks that are including the experts and managers and relevant subsidiaries (like committees and expert panels) (Organisation, Culture) **O5:** To change vertical and complicated structure to a flat and simple structure and in some cases project-oriented (Organisation, Culture) **O7:** To corporate oil and gas companies with IT companies to design and develop oil and gas industry applications (Technology, Software) **O8:** To formulate strategic document (vision, mission, strategies, objectives, etc.) with corporation of personnel as it has been clarified and simplified (not complicated) (Organisation, Structure)	**G1:** To force managers, experts, personnel and stakeholders in use of IT and web-based systems (KM and e-business) (Organisation, Culture) **G2:** To facilitate knowledge communication between organisation and stakeholders (Organisation, Culture), To formulate KM and e-business strategies with accordance to strategic document with corporation of personnel (Organisation, Culture) **G5:** To benchmark e-business and KM systems and best practises in oil and gas industry and also design and use of them in the organisation (Technology, Software) **G8:** To formulate and simplify the specific regulation, design and integrate IT systems and to share knowledge (Organisation, Culture)

Table 5-13: The required changes, which should be done in the internal competencies of NIOC and NIGC subsidiaries for transferring a KBO by e-enabled knowledge network

The next cross-case analysis is about the outcomes of e-enabled knowledge network on the strategic capabilities in the NIOC and NIGC subsidiaries. Strategic capability is described as the collection of resources, skills and capacities, which construct long-term competitive advantage for a company (Jalonen and Lonnqvist, 2011). Tables 5-14 demonstrate some pending outcomes of e-enabled knowledge network on the strategic capabilities in NIOC and NIGC subsidiaries.

According to absorptive capacity definition, it is described as part of organisational activities, which companies use to acquire, assimilate, share and exploit knowledge to provide a dynamic organisational capacity (Chen et al., 2009). The subsidiaries have been successful in utilisation of e-enabled knowledge network to gain absorptive capacity in both NIOC and NIGC, which have made knowledge networks (O1, O3, O9, O13, G1 and G9), expert panels (O9, G4, G10

and G11), professional or technical forums (committees or teams) (O1, O3, O6, O9, O13, O15, G1, G4, G11) and think-tanks (O6) in their organisations. The subsidiaries that usually have valuable results in absorptive capacity; the majority of their activities are based on projects. It means that these subsidiaries are highly experienced in carrying out projects, such as Exploration management (O9), Dispatching management (G10), Management of Coordination and Supervisory of Production (G9), R&D management (O6) and Planning management (O13).

The e-enabled knowledge network can enable an organisation to become an agile organisation. Agility is the capability of the company to redesign its available processes speedily, and form new processes in a timely manner to make the most advantages of dynamic market circumstances (Zaini and Masrek, 2013). Changing vertical structure of organisation to a flat, flexible or matrix structure are the most important changes for agility through e-enabled knowledge network, which were mentioned by the NIOC subsidiaries (O1, O6 and O13), while the main changes were mentioned in changes in methods and programs (G1), systems (G4 and G9) and applications (G10) by the NIGC subsidiaries.

As shown on Table 5-14, the subsidiaries' experience demonstrates that innovation can be changed in NIOC and NIGC through the e-enabled knowledge network. Drejer (2003) recognised five activities, which jointly describe innovation management: process of new product development, technological integration, strategic technology planning, business development, and organisational change. Both the NIOC subsidiaries and the NIGC subsidiaries explained that the e-enabled knowledge network can create innovation first in their systems and software (applications) and then in their products. For instance, O1, O3, O6, O13 and O15 in NIOC and G1, G4, G9 and G10 in NIGC emphasised on innovation in systems and applications, while O9 and G11 explained innovation in the products.

Resilience is a new concept in management. Organisational resilience is the capability to survive a crisis and prosper in a world of uncertainty (Whitman, 2014). The e-enabled knowledge network can have an effect on organisational resilience in the NIOC and NIGC subsidiaries. Two companies NIOC and NIGC should be ready for an appropriate reaction to the country oil and gas crisis, like ignoring the sanction impacts for supplying the oil and gas equipment (O9), controlling irregular consumption of fuel (O15), preventing the cut of gas flow in the country (G9, G10 and G11) and saving financial source while the organisation has sanction on some commodities (G4). Some of the subsidiaries also are project-based, the results shows that being resilient in different parts of their project have importance like supplying the required workforces (O3), reducing repetitive projects (O6) and retaining the health and safety of personnel and equipment with respects to the shortage of skilful workforces and expensive

equipment, optimisation of energy use and resources, thus minimising wastes and pollutants (G1).

In conclusion, the outcome of this cross-case study illustrates that the strategic capabilities is dependent on the internal and external conditions of the organisation. NIOC and NIGC could only be agile when they had to manage a crisis. However, the subsidiaries of NIOC have mainly worked on organisational structure, whereas, the NIGC subsidiaries have managed to design applications that can manage the crisis.

In absorptive capacity, with respect to previous knowledge management projects that were carried out in NIOC and NIGC and being familiar with knowledge management systems, the two companies' subsidiaries have used technical forums, knowledge networks and expert panels in their activities.

In innovation, the findings has shown that when the NIOC subsidiaries have faced a crisis, they were able to illustrate their innovation abilities, whereas, the NIGC subsidiaries have inherited their innovation abilities from their creative and experienced managers.

Finally, the NIOC subsidiaries were shown to be resilient when they faced a crisis where they had to manage it. However, the NIGC subsidiaries resilience has appeared when their experienced managers were able to design and customise the required applications.

Strategic Capabilities	NIOC	NIGC
Absorptive capacity	**O1:** Knowledge networks, Professional teams **O3:** Knowledge networks, Professional committees **O6:** Think-tanks, Professional forums, Technical committees **O9:** Knowledge networks, Expert panels, Technical committees **O13:** Knowledge networks, Professional forums **O15:** Customers suggestions system, Government supervisory system, Professional committees	**G1:** Knowledge networks, Professional committees **G4:** Expert panels, Technical forums **G9:** Technical forums, Knowledge networks **G10:** Expert panels, Technical forums **G11:** Customer suggestion system, Expert panels, Professional Networks
Agility	**O1:** Design a flat and flexible structure **O3:** Adapt HR requirements of the organisation with HR market **O6:** Change vertical structure to flat structure **O9:** Response to the company demands **O13:** Change vertical structure to matrix and flat structure **O15:** A solution for nullifying sanctions impacts on fuel imports	**G1:** Assess and review the methods and programs in health & safety and environment **G4:** Prevent re-buy of the commodities and equipment **G9:** Manage and control repairs of gas pipelines **G10:** Unique application **G11:** Reduce lost gases
Innovation	**O1:** Design a new software and organisational structure	**G1:** Design an integrated system for providing and maintaining the required training and identifying,

	O3: Design a system (includes elite recruitment, suggestion, training, etc.), Establish new universities, schools and fields for oil and gas **O6:** Design an application to control the projects processes **O9:** Design a new drilling bit, Find new market for new product **O13:** Design a new system **O15:** Design a new and unique system in the world	assessing, eliminating and/or controlling effectively the potential hazards under normal, changing and critical conditions **G4:** Design a system to manage the organisation purchase for the required commodities and equipment **G9:** Video conference system **G10:** Design a new system which is a best practice in the world **G11:** Intelligent gas counter reading
Resilience	**O1:** Control and view markets in respects to oil and gas industry **O3:** Supply the required workforces **O6:** Reduce repetitive projects **O9:** Ignore sanctions impacts **O13:** Achieve opportunities and avoid threats to the internal and external environment via reports to managers and stakeholders **O15:** Control irregular consumption of fuel	**G1:** Retain the health and safety of personnel and equipment with respects to the shortage of skilful workforces and expensive equipment, Optimisation of energy use and resources, thus minimising wastes and pollutants **G4:** Save financial source while the organisation has sanction on some commodities **G9:** Prevent the cut of gas flow in the country **G10:** Prevent gas flow cut off when three gas pipelines exploded **G11:** Reduce the cut of gas flow

Table 5-14: The outstanding outcomes of e-enabled knowledge network on the strategic capabilities in the NIOC and NIGC subsidiaries

The next cross-case analysis between NIOC and NIGC is about organisation performance and the outcomes of e-enabled knowledge network on the organisation performance in the subsidiaries (Table 5-15). Organisational performance is constituted of the real output or outcomes from an organisation as measured against its aimed outputs (objectives and goals) (Liapreecha and Chamnanchang, 2013). The organisation performance had been assessed financially and non-financially.

The NIOC and NIGC subsidiaries, which have had appropriate actions in the sanction conditions and in carrying out their projects, have had improvement of organisation performance with the use of the e-enabled knowledge network. For example, Management of Exploration (O9) reduced to buy new products, HR management saved financial resources (O3), R&D management reduced the costs of projects (O6), Management of International and Commercial affairs (G4) reduced the purchase costs of commodities and equipment, Management of Coordination and Supervisory of Production (G9) reduced the traveling costs. It is shown that the NIOC and NIGC subsidiaries have similar performance in carrying out the projects when the environmental conditions and an appropriate plan are available.

Organisation Performance	NIOC	NIGC
Financial organisation performance	**O3:** Save financial resources by 28 %, **O6:** Reduce the costs of projects from £500,000 to £300,000 per year **O9:** New product price £5,600 (£10,000 with sanction) to £3,300	**G4:** Reduce the purchase costs of commodities and equipment by 30 %, **G9:** Reduce the traveling costs £80,000 to £10,000 (per year) **G11:** Reduce the cost of gas counter reading by 80 %
Non-financial organisation performance	**O1:** Reduce number of personnel by 20 %, Increase rate of useful information by 35 % **O3:** Increase number of suggestions from 300 to over 2000 per year, Reduce transfer of employees abroad from 40 to less than 5 people per year, Increase the fields of oil engineering in the country from zero to 2 petroleum universities, 8 oil engineering schools and over 15 petroleum institutes and research centres **O6:** Remove repetitive projects resulting in reduce number of projects from 185 to 121 projects per year, Check and view the project situation wherever and whenever by stakeholders **O9:** Reduce supply period from 3 months to 2 weeks, **O13:** Reduce time of response to managers from 3 hours to 30 minutes **O15:** Petrol consumption: 95 million litre/day with 15 million vehicles, reduced to 75 million litre/day with 25 million vehicles, Decrease the time of decision to action points from 3 months to 2 days, Customers satisfaction due to fuel costs payment with debit card instead of cash	**G1:** Reduce number of incidents from 140 to 65 cases/year), Reduce number of complaints (environmental and health) from 26 to 12 cases **G4:** Reduce the time of order to receive point from 6 to 2 weeks **G9:** Reduce the repairs time from 8 to 5 weeks, Reduce the time of decision making from 10 to less than 2 day **G10:** Disconnection of gas supply in the country, Reduce repairs times from 12 to 8 week, Reduce cut gas flow twice in a month to zero (exception strong cold temperature) **G11:** Reduce the lost gas by 60 %, Reduce attend of customers to the gas offices by 65 %,

Table 5-15: The outstanding outcomes of e-enabled knowledge network on the organisation performance in the NIOC and NIGC subsidiaries

The results of non-financial organisation performance of the NIOC and NIGC subsidiaries demonstrates that the main effort have been focused on the reduction of time of activities and processes. Consequently, it can lead to reduce the organisational cost, indirectly. For example, Management of Planning (O13) reduced time of response to managers, National Iranian Oil Production Distribution Company (O15) decreased the time of decision to action points, Management of International and Commercial affairs (G4) reduced the time of order to receive point, Management of Coordination and Supervisory of Production (G9) and Management of Dispatching (G10) decreased the repairs time. They also have had some outcomes in respect to customer and personnel satisfaction. For instance, Management of HSE (G1) has reduced number of complaints, Management of Dispatching (G10) has decreased to cut gas flow in the country, Management of Distribution (G11) has declined to attend customers in the gas offices, HR Management (O3) has increased in number of suggestions (personnel and customers),

National Iranian Oil Production Distribution Company (O15) has increased in rate of customers satisfaction due to fuel costs payment with debit card instead of cash.

Generally, the results of the organisation performance demonstrate that NIOC could design and utilise some applications, which have efficient and effective performance in HR (O3), R&D (O6) and International and Commercial Affairs, while NIGC have succeeded in design and use of operational applications such as Dispatching (G10), Distribution (G11), Refineries (G9) and HSE (G1).

CHAPTER 6: CONCLUSION AND FUTURE RESEARCH

Introduction

This chapter consists of six parts; introduction, research summary, research discussion, contribution to knowledge, research limitations and future research opportunities. The research summary presents the steps of the research. The research discussion summarises the thesis results and provides answers to the core questions. Also, the contribution to knowledge is discussed. Then, the research limitations are explained and finally, some recommendations for future research will be mentioned.

Research Summary

The main objective of this study was to contribute to the subject knowledge by extending the literature on the theoretical and practical aspects of the interrelationships between the two sets of strategies (KM and e-business) for establishing KBO in the Oil and Gas industry. The following steps were carried out to answer the research questions and achieve the main objective of the study:

➢ KM and e-business and KBO models and theories and their relationships with modern organisations, technology, strategic capabilities (agility, absorptive capacity, organisational learning, innovation and resilience) and organisational performance were studied as well as the models and definitions of KM, e-business and KBO in the oil and gas industry were reviewed in the literature.

➢ The components of the e-business model and the KBO model were identified based on the literature and a research model which had been made from the integration of KM and e-business strategies. Furthermore, the components of the KBO model were designed in the conceptual framework.

➢ The outcome of the integration of KM and e-business strategies for transferring an organisation to a KBO was the e-enabled knowledge network, which impacts on strategic capabilities and organisation performance

➢ The core questions and the propositions were designed based on the research model

- A qualitative research methodology was designed and methods including case study and interviews were used to collect data with a semi-structured questionnaire supported by secondary data.

- An expert panel was also formed of seven academic and professional experts in the Iranian oil and gas industry. The outcomes from the panel were selection of the cases studies (NIOC and NIGC and their subsidiaries (31 SBUs and companies) based on Bain model), validation of the research model and the questionnaire based on method of CVI (The index of content validity), and a final review of the results.

- The required permits were taken from the university and the cases studies and 31 experts were interviewed during the field study

- The research results were analysed by Nvivo

- The results were interpreted and subsequently discussed

Research Discussion

The research model was designed based on the objective and the main research questions. It was also developed from the literature and e-business and KBO models, which were designed in the research. The research model and its components were explained in totality in the conceptual framework. The core questions were designed with respect to the main research questions and the research model. Finally, the propositions were designed in accordance to the research model and the core questions. The results of the propositions were discussed in chapter 5. The core questions of the research are discussed in this part.

Core Question 1: How e-enabled knowledge networks assist organisations in achieving the characteristics of a KBO through facilitating the flow, assimilation and application of knowledge, from outside and inside the organisation, by devising and implementing e-business and KM strategies?

The research model, which was designed in the conceptual framework of this research, demonstrated how e-business strategy and KM strategy should be developed and integrated to support an organisation in becoming a KBO. The research model is derived from the analysis of the relationships between KM, e-business and KBO models which have been designed separately. According to the literature review, e-business strategy addresses how employees,

departments, suppliers, customers, communities, strategic entities and partners and their activities can be enabled by web-based IT in an organisation (Julta et al., 2001; Chaffey,2007; Janssen et al., 2008). On the other hand, e-business strategy is aligned with the organisation's strategies and business processes via IT (Maahlo et al., 2012). In fact, the web-based IT is the core of an e-business strategy which helps to build the knowledge networks, and facilitates the knowledge flow in an organisation (Bremser and Chung, 2006; Sorenson, Rivkin and et al., 2006).

KM strategy is the other part of the research model. It is a scheme that details the manner in which an organisation manages its knowledge in an improved manner to the advantage of that organisation and its stakeholders (Choi et al., 2008); Also, KM strategy is aligned with the organisation's overall strategy and objectives (Chen and Liang, 2011). Knowledge management systems (KMS) are the core of KM strategy (Halawi et al., 2006) that includes sourcing a professional or a documented origin of knowledge with the assistance of online directories and searching databases; knowledge sharing and collaborating in virtual groups; availability of data from previous projects; and finding out about customer behaviour and requirements through evaluation of transaction information, among other things (Hsia et al., 2006). Therefore, KMS helps to build the communication networks in an organisation.

When knowledge is created, knowledge networking comprises the fundamental procedure to create new knowledge. Networking knowledge may generate a portion of knowledge which has information value that extends past the simple total of the individual portions, i.e. it results in new knowledge. Using the Web, the organisation has a basic infrastructure in position enabling the connecting of information on an international scale. Knowledge is the core of an organisation's progressively more activities of digital services; linking information forms the foundation of organisational productivity (Decker and Hauswirth, 2008).

The theory of e-business strategy has been initiated to deal with the matter of the manner in which the internet can restructure firms and offer competitive advantage. Contributors detailed the various viewpoints of the challenge, ranging from business models to management, and from marketing to operations (Urban and Brynjolfsson, 2001). In fact, an obvious e-business strategy has provided orientation for the firm, defining it as a banner for the entire organisation to unite beneath (Jackson and Harris, 2003). Normally, fruitful utilisation of e-business necessitates creating an inventive connection linking the strategy of the organisation and technology reinforcing it, and controlling persistent information and communication technology applications which are progressively convergent and integrated, and which enable adaptive and flexible behaviour from the company and its stakeholders (Sohal and Dubelaar, 2005).

When networked and communicated knowledge emerge from knowledge management, and integrated knowledge based networks result from e-business interactions with each other, the outcome from the interrelation of these two dimensions is an e-enabled network of knowledge which brings the knowledge from the inside and outside of the organisation together to serve the organisation's growth and improved performance, and ultimately its competitive advantage. The organisation is subsequently expected to identify the characteristics of a KBO.

Core Question 2: How e-enabled knowledge networks assist an organisation to become a KBO?

When e-enabled knowledge network can change internal competencies of organisation for improving and developing strategic capabilities and organisation performance, it can assist an organisation to become a knowledge-based organisation.

Internal competencies: The successful adoption of knowledge management and e-business systems when e-enabled knowledge network is implemented requires the development of the internal competencies (Chaston and Mangles, 2002; Fiers and Williams 2003). Three dimensions of internal competencies are identified in an organisation that facilitates the adoption of knowledge management and e-business systems including: 1) the individual dimension which includes: awareness (Boyatzis, 2008), trust (Hayton and McEvoy, 2006) and personality (Geoghegan and Dulewicz, 2008); 2) the technological dimension which includes: tools and infrastructure (Knezek and Christensen, 2008); and 3) the organisational dimension which includes: structure (Tyagi and Sawhney,2010), culture (Cameron and Quinn, 2011) and work process (Cardy and Selvarajan, 2006).

According to Tables 5-8, here are some evidences, which demonstrate how e-enabled knowledge networks influence organisations at organisational, technological and individual levels.

The Planning Management (O13), HR Management (G2), KM Division (O5), Exploration Management (O9), Structure Management (O8), HSE Management (O2), Structure Management (G8) explained that e-enabled knowledge network should be affected at organisational level. They mentioned that the changes such as updating knowledge of the experts and benchmarking best practices, facilitating knowledge communication between organisation and stakeholders, forcing managers, experts, personnel and stakeholders in use of IT and web-based systems (KM and e-business) and having motivation programs to share

knowledge between personnel are examples of organisational culture. Iran Oil Pipelines and Telecommunication Company (O17) and Iranian Gas Engineering and Development Company (G12) pointed out that e-enabled knowledge network affect the organisational structure. They stated that the changes such as changing vertical and complicated structure to a flat and simple structure and in some cases project-oriented and forming professional COPs and knowledge networks that are including the experts and managers and relevant subsidiaries (such as committees and expert panels) are examples of the organisational structure. Iranian Gas Transmission Company (G13), HSE Management (G1) and Structure Management (G8) have mentioned that e-enabled knowledge network has impacts on work processes of organisation. They explained that the changes like formulating and simplify the specific regulation, design and integrate IT systems and to share knowledge, designing applications and systems with corporation of personnel for communication with stakeholders and; recruiting and using experienced and skilful managers and experts in the specific and key positions are examples of work processes of organisation.

Research Institute of Petroleum Industry (O7), Management of Export and International Affairs (O1), Manufacturing Support and Procurement Kala Naft Company (O14) and KM Division (G5) clarified that e-enabled knowledge network can affect the technological tools. They pointed out that the changes such as cooperating oil and gas companies with IT companies to design and develop oil and gas industry applications, increasing security of IT system to prevent hackers attack, providing the required equipment and applications to integrate the current KM and e-business systems; and benchmarking e-business and KM systems and best practises in oil and gas industry and also design and use of them in the organisation are examples of the technological tools and infrastructure.

Distribution Management (G11) explained that the changes should be done in trust of individual like increasing rate of team work and knowledge sharing by e-enabled knowledge network. Management of Coordination and Supervisory of Production (G9) mentioned that the changes should be done in awareness of people like recognising and use the current IT and web-based systems by e-enabled knowledge network. Finally, National Iranian Oil Refinery and Distribution Company (O16) pointed out that the changes should be done in personality of people like enhancing people skills by e-enabled knowledge network.

Strategic capabilities and organisation performance: As mentioned in the KBO model, a knowledge-based organisation is an ICT and web (e)-enabled organisation which uses knowledge through a process of acquisition, distribution and utilisation to lead to innovation, learning, effective communication and efficiency in the organisation. Also, as explained, an organisation can acquire, distribute and utilise knowledge through web-based systems (Sivenco,

2008), but if this knowledge cannot lead to innovation (Darroch, 2005), organisational learning (Kanchana et al., 2011), absorptive capacity (Liao et al., 2007), value chain (Danskin et al., 2005), agility (Sherand Lee, 2004) and resilience (Alavi et al., 2006), this organisation is not considered a knowledge-based organisation. As a result, when e-enabled knowledge networks are in place, they lead to the creation, improvement and development of the strategic capabilities in the organisation; it can be expected that the organisation will be transformed into a knowledge-based organisation.

Strategic capability is described as the collection of resources, skills and capacities which construct long-term competitive advantage for a company (Jalonen and Lonnqvist, 2011). It comprises the capability to work in the direction of a vision constructed on the value adding aspects applicable to the company and a plan for revenues that has the correct balance amid making the most of short term opportunities and long term actions in order to attain sustainability in business. According to the literature and the KBO model, the strategic capabilities are innovation, organisational learning, absorptive capacity, value chain, agility and resilience in the organisation.

The oil and gas companies are doing many oil and gas projects to produce oil and gas for maximising profit and quality. Therefore, the companies concentrate their activities on exploration of new oil and gas fields, development and maintenance of the current oil and gas fields. The core of the projects is human resources (HR) and equipment. Cost and time are two key factors in carrying out the projects. If the oil and gas companies employ human resources and/or equipment inappropriately, this can increase the cost and/or the time of the projects, and even lead to failure. Therefore, they measure their organisation performance and improve and develop the strategic capabilities in the organisations, continuously.

When an organisation is transformed into a KBO, the strategic capabilities arising from e-enabled knowledge networks are expected to have considerable impacts on the company's performance. Organisational performance is constituted of the real output or outcomes from an organisation as measured against its aimed outputs (objectives and goals) (Liampreecha and Chamnanchang, 2013). The most important indicators for measuring organisation performance are divided two groups; financial and non-financial (Broadbent and Laughlin, 2009). An organisation can identify how much e-enabled knowledge network has been successful when financial indicators measure the financial statements and documents. Financial performance indicators measure and demonstrate organisation revenue such as amount of sales and profit and cost of operations (Moneva et al., 2007). On the other hands, non-financial indicators are not easily recognised in organisations. They demonstrate organisation performance through

measuring factors such as customer satisfaction, market share and time of operations (Coram et al., 2011).

Core Question 3: What effects should be expected in the organisation performance both in terms of strategic capabilities and general performance as the result of development of e-enabled knowledge networks?

As discussed in proposition 5 and 6, the strategic capabilities and organisational performance were influenced as a result of the development of the e-enabled knowledge network. Here, the researcher answers the core question 3, briefly.

The e-enabled knowledge network could impact on the strategic capabilities of the organisations. It can redesign the organisation processes quickly and make new processes and also a flat and flexible structure for the organisation. The knowledge networks, professional and technical teams, with use of the web-based systems, connect to HR and financial resources, and also gain the required information from internal and external environments. These changes help to adapt the organisation to the dynamic environment making an agile organisation. For instance, as the manager of Distribution management (G11) explained, e-enabled knowledge networks lead to reduced loss of gases.

In addition, it assists the organisation to recognise the value of new information when it assimilates the relevant internal and external information (absorptive capacity). Therefore, the organisation has been changed to a learning organisation. For example, the knowledge networks, professional forums and technical committees and also customer suggestion systems are the results of using e-enabled knowledge networks for exploiting the internal and external knowledge in the organisation.

The managers and personnel can access the required knowledge from the stakeholders while this knowledge supports the knowledge networks and professional and technical teams, they can satisfy their needs and recognise their opportunities, threats, strengths and weak points. Thus, they are able to design the required software, applications, system, method, technology, structure and products (innovation). Designing and producing a new drilling bit by Exploration management (O9) and an intelligent gas counter reading by Distribution management (G11) are examples that show how e-enabled knowledge network leads to design and production.

Also, e-enabled knowledge networks can save the organisation from crisis. As mentioned previously, the SKADA system of dispatching management (G10) which is an e-enabled knowledge network prevented the disconnection of gas flow when three main gas pipelines exploded simultaneously. Therefore, it causes the organisation to be a resilient organisation.

As explained in proposition 6 and demonstrated in Tables 5-10, e-enabled knowledge networks can have an impact on organisation performance. Its most important impacts on the organisation are:

The HSE system of NIGC (G1) can increase knowledge flow via the integration of HSE systems of the subsidiaries with the acquired knowledge of the professional committees and knowledge networks. The HSE system can reduce number of incidents annually from 140 cases to 65 cases and also the number of health and environmental complaints have been reduced from 26 cases to 12 cases annually. The Purchase management system of international and commercial affairs (G4) could reduce the purchase costs of commodities and equipment by 35 % annually and reduce the order delivery time from 6 to 2 weeks. The management of coordination and supervisory of production (G9) uses a refinery management system. The system has reduced the repair time from 8 to 5 weeks and the travelling cost £80,000 to £10,000, annually. Also, the process time of decision-making has reduced from 10 to less than 2 days. Dispatching management (G10) uses the SKADA system. It could also reduce the repairs time from 12 to 5 weeks and reduce disconnection of gas flow from twice in month to zero (exception strong cold temperature). The system of distribution management (G11) controls the gas flow from the main gas pipelines to the consumption point. It could reduce the lost gas by 60 % and the cost of gas counter reading by 80 %, annually. Also it reduced the number of customer attendance to the gas offices by 65 %.

One of the most important tasks of planning management (O13) is to decide and plan when an unexpected issue occurs in the organisation. The respond time between managers and stakeholders has reduced from 3 hours to 30 minutes via the planning system. Export and international affairs (O1) use a system, which is linked to professional teams and knowledge networks. They designed a system to control and view the situation of the oil and gas market in the world. Therefore, it is not necessary for the managers and experts to view and control the markets in their office; thus, it reduced number of personnel by 20% and the rate of useful information increased by 35% in the organisation, annually. The comprehensive system of HR management (O3) has reduced to transfer skilful workforces abroad for educational purposes from 40 to less than 5 people per year. The suggestion management of this system has increased the number of suggestions from 300 to over 2000 annually so that it saves financial resources by

almost 28%. The Project management system of R&D (O6) has removed the repetitive projects and the number of the projects reduced from 185 to 121 projects per year. Additionally, the number of projects that has been processed has been reduced as well. Consequently, the costs of projects have decreased from £500,000 to £300,000 per year. The satisfaction of the stakeholders has increased, because they can check and review the project situation at any time. EPM is a system of Exploration management (O9), which caused to reduce the supply period for commodities and equipment from 3 months to 2 weeks.

Finally, the Smart fuel system of NIOPDC (O15) could reduce the petrol consumption from 95 million litters/day with 15 million vehicles in 2006 to 75 million litters/day with 25 million vehicles in 2014. The customer satisfaction has increased because they can pay the fuel cost with their Smart Fuel Card, which is connected to their bank accounts. Also, the system could decrease the time of decision to action points from 3 months to 2 days in NIOPDC.

Core Question 4: What are individuals, organisational and technological barriers to achieve such integration and becoming a KBO?

The results demonstrated that the following technological, organisational and individual barriers prevent organisations from becoming knowledge-based organisations.

The NIOC and NIGC subsidiaries explained that the most important technological barriers include information security and hackers attack, which are major factors in avoiding the usage of web-based systems or connecting to other systems via internet (web) (Manufacturing Support and Procurement Kala Naft Company (O14)); unintegrated systems are systems that work separately and do not connect to each other. The systems were designed to do specific tasks and cannot connect to other systems. IT designers and experts have to re-design or modify systems, both of which incur considerable costs for the organisations (HSE Management (G)); lack of knowledge of the IT companies about oil and gas industry causes systems to be inefficient and ineffective when they are being designed. Consequently, IT companies cannot update and customise the existing systems properly (Research Institute of Petroleum Industry (O7)); and finally, lack of appropriate technological infrastructure, equipment and instruments of some stakeholders especially in new oil and gas fields and operational areas such as satellites, optical fibre and the required equipment for connecting to the web (Management of Export and international Affairs (O1)).

The major problem in technological barriers is lack of professional IT teams and experts in NIOC and NIGC. The companies require people, which know both oil and gas activities and processes and are familiar with IT, KM and e-business systems. The universities and IT

companies could not design the required systems and solve problems. Therefore, as NIOC and NIGC established a university for supplying the required experts in oil and gas engineering; it is necessary that they establish their required experts in IT, KM and e-business systems in their institutes and universities, which can design the required systems.

Organisational barriers also were mentioned by the NIOC and NIGC subsidiaries. The organisational barriers comprise: the system designers do not receive any comments and feedback from the users in the organisation (HR Management (G2)); constantly changing managers as they are usually selected politically, although they are sometimes selected from other companies. Therefore, it takes time for them to become familiar with the organisation systems and the existing problems. Even in some cases, they do not believe in the current systems and the organisation is forced to change the existing systems (Exploration Management (O9)); high organisational bureaucracy. The permits and managers signatures, and also meeting with managers and experts are required for deciding and designing a new system or modifying the current systems and thus, it takes several months (Iranian Gas Engineering and Development Company (G12)); regulations: some permits do not allow changes to the new systems (Structure Management (G8)); lack of competition in the oil and gas markets (monopoly). The oil and gas companies (producers of crude oil and oil products) have specific customers and the customers cannot easily change their suppliers because they provide their technology and equipment in accordance with the kind of crude oil or oil products that they buy (Planning Management (O13)); high amount of works cause everydayness in employees, so they do not have enough time for brainstorming (Management of Law Affairs (G6)); lack of information about new and current systems capabilities by employees (Iranian Gas Engineering and Development Company (G12)); failure in some projects leads to decreased motivation in employees for using the systems (Technology Management (O12)); lack of experience in using e-business and KM systems in the organisational culture. This means managers, experts and staff do not become familiar with the advantages of systems to help themselves and their organisation (KM Division (G5)); lack of professional and technical networks and forums result in inability to design new systems or modify and customise the current systems (Iran Oil Pipelines and Telecommunication Company (O17)); lack of staff training to use the systems (HR Training Division (G3)); the employees of the oil and gas industry are not familiar with the new techniques, methods, software and equipment. Some e-business systems have the ability to link to the other systems, but unfortunately the managers and experts are not aware of these capabilities (Management of Coordination and Supervisory of Production (G9)).

The results of the organisational level show that information and notification system are weak and also the rules and regulations need to be revised according to the new technology. Before

and after designing the systems, it is necessary that all relevant staff are trained and involved in design of the new systems.

The last barriers are individual. The NIOC and NIGC subsidiaries explained that the most important individual barriers comprise: some stakeholders are not interested in using the designed systems on the web (Institute for International Energy Studies (O4)); employees are reluctant to share their knowledge as they claim their knowledge is their intellectual property and by sharing it, they increase the risk of replacement and losing their positions (KM Division (O5)); some managers do not believe in the designed IT systems. While the required systems have been provided, some managers prefer to use the traditional methods to carry out their tasks and activities (Management of International and Commercial affairs (G4)).

The essential factor of the individual barriers is weakness of management in organisation. This means that if senior management are firmly resolved to make use of knowledge management and e-business systems and implemented throughout the organisation, all employees, stakeholders and even managers will be required to use the system in the organisation.

Contribution to Knowledge

The results of the research included in this thesis indicate the contributions of this thesis to knowledge. Although this research focuses on the integration and interrelation of e-business strategies and KM strategies, it assisted to broaden the perception of knowledge in support of organisations becoming knowledge-based organisations in general. The contributions of this research can be outlined as following:

❖ A focus on strategies to become KBO, and its relationship with organisation's e-business strategy is not addressed well in the existing works. Particularly, such a study is missing in the strategic industry of oil and gas. As such, this research aims to contribute to the subject knowledge by extending the literature on theoretical and practical aspects of interrelationships between the two sets of strategies (Knowledge and e-Business), and also developing an appropriate e-business strategy model for establishing KBO in the oil and gas industry.

❖ The designed e-business strategy model of the research was a combination of the e-Business Stakeholder Model (Jutla, Craig et al. 2001), Siemens Model (e-Business Strategy Check Methodology) (Damen, 2002) and the stages of building an e-business strategy (Alhawamdeh, 2007). And also, the designed e-business model of the research

was the result of analysing and integrating 17 models (appendix 2) developed by researchers (i.e. Timmers, 1998; Chateau, 2000; Julta et al., 2001; Applegate, 2001; Porter, 2001; Miler 2001; Damen, 2002; Lowry, 2002; Vassilopoulou et al., 2003; Ash & Burn, 2003; Rappa, 2004; Jelassy & Enders, 2005; Daughfous, 2006; Alhawamdeh, 2007; Lin, 2008; Lin, 2011).

❖ A Knowledge-based organisation (KBO) was defined in this research as an ICT (and web)-enabled organisation which uses knowledge acquisition, distribution and utilisation to lead to innovation, learning, communication and efficiency in the organisation. As mentioned in the literature review, an organisation can acquire, distribute and utilise knowledge through web-based systems (Sivenco, 2008), but if this knowledge cannot lead to innovation (Darroch, 2005), organisational learning (Kanchana et al., 2011), absorptive capacity (Liao et al., 2007), value chain (Danskin et al., 2005), agility (Sher and Lee, 2004) and resilience (Alavi et al., 2006), this organisation is not a knowledge-based organisation.

❖ The research model was derived from the analysis of the relationships between KM, e-business and KBO models which were designed in this research, separately. The research model demonstrated how e-business and KM strategies should be developed and integrated to support the organisation to become a KBO.

❖ The e-enabled knowledge network is an outcome of the integration of e-business and KM strategies. The e-enabled knowledge network is where KM and e-business strategies have a common point for gathering knowledge from inside and outside of the organisation. When networked and communicated knowledge emerged from knowledge management, and integrated knowledge based networks resulted from e-business interaction with each other, the outcome from the interrelation of these two dimensions was an e-enabled network of knowledge which combines the knowledge from the inside and outside of the organisation to serve the organisation's growth and improved performance and ultimately competitive advantage. The organisation is subsequently expected to identify the characteristics of a KBO.

❖ Integration of e-business and KM strategies and having e-enabled knowledge networks is not enough to transfer an organisation to a KBO, they must be able to impact and improve the strategic capabilities and the organisation's performance.

❖ The individual, technology and organisation barriers which prevent integrating e-business and KM systems were recognised in the oil and gas industry.

❖ e-Enabled knowledge networks can help experts of the oil and gas companies in:

- o Accessing the market information, e.g. new energies (solar, hybrid, etc.), new technologies, new productions, etc.

- o Informing about political and economic events, such as signing a contract between countries (for instance building a gas pipeline), sanction and war on oil-producing countries

- o Carrying out a higher number of projects through using experiences from other projects while they are being updated

- o Recognising the most appropriate experts to carry out the projects through e-enabled knowledge networks

- o Applying the most efficient and effective technologies by adapting existing knowledge and available knowledge from internet and knowledge which has been customised by experts. Therefore, the most appropriate and newest technologies in implementation of their project are used

- o Predicting when unexpected problems may occur in their project and having immediate access to a great deal of the information from the internal divisions and the external environment of their organisation.

Research Limitations

The research had some limitations throughout the study. The most important limitations of the research were:

- Accessing mangers, experts and professors in the field of the oil and gas industry was highly difficult.

- Some required information in connection with the oil companies is confidential, therefore accessing it was difficult.

- Some problems, which the researcher had in the interviews include:

  - One of the hardest parts of the interview with managers was to book an appointment for meeting

- The interview interruptions, such as phone calls from superior managers or others and the manager having to leave the meeting

- Overlapping two meetings, because the first meeting lasted too long and the researcher had to acquire the information from the manager in a shorter time slot.

- Some managers felt that all the information was confidential and they avoided giving the required information.

- Reaching a common understanding about the key terms of the research between manager and researcher.

- Some managers did not permit their voices to be recorded, thus notes had to be taken, continuously.

- Many kinds of companies, SBUs, activities and processes are in the oil and gas industry, therefore many managers and experts are available, therefore, the selection process was difficult.

- Many softwares, IT systems and processes are confidential in the oil and gas industry.

- Analysing with Nvivo was difficult. The majority of students prefer not to use Nvivo, because it requires entering a high volume of data into Nvivo. Also, designing models and exporting reports is difficult. Unfortunately, none of students I know learnt to use Nvivo. Therefore, I had to watch many training movies and read a lot of document to learn Nvivo.

Future Research Opportunities

The research has some proposals for future studies. They include:

➢ The effects of e-enabled knowledge networks can be studied on different strategic capabilities and organisation performance. Agility, absorptive capacity, organisational learning, innovation, resilience and other strategic capabilities can be studied separately with regard to how e-enabled knowledge networks can influence them.

- The research has been done in the companies of an oil-based country in the Middle East. The future research can be done in multinational oil and gas companies in developed countries.

- The research demonstrated that the oil and gas companies of a country with an oil-based economic are successful in projects. The future research can study whether these kinds of companies can change their structure to a more project-oriented structure?

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APPENDICES

Appendix 1: Knowledge Management (KM) Models

Author	Jennex (2007)	Lytras & Pouloudi (2003)	Fahey et al. (2001)

components	**KM processes**
	
	Acquisition
	  Creation
	  Discovery
	  Gathering
	  Validation
	Distribution
	  Dissemination
	  Maintenance
	  Sharing
	  Reuse
	Organization
	  Modelling classification
	  Calibration integration
	
	Organizational, social and managerial elements
	
	Motivation, Communities, Systems Architecture, Integration and Lifecycle, Social Networks, Trust, Privacy, Transfer, Strategy, Competitive Advantage, Organizational Learning and Organizational Memory, Cooperation, Intellectual Capital, Culture, Metrics
	
	Supporting and Enabling Technologies
	
	Portals, Mobility, Meta-knowledge, Networks, Data Mining, Interface, Human Factors, Security, Encryption, Access control, Computer Mediated Communication, Unstructured Data Indexing and Storage, Semantics and ontology, software and agent
		Monitor and facilitate knowledge related activities
		
		Survey and map the knowledge landscape
		Oversee knowledge asset management
		Manage intellectual assets
		Implement incentives to motivate knowledge creation, sharing and use
		Pursue knowledge focused strategy
		Restructure operations & organization
		
		Establish and update knowledge infrastructure
		
		Enterprise-wide lesson learned program
		Knowledge bases with organized ontology
		Knowledge professionals resource pools
		Knowledge inventories
		Comprehensive multi-path knowledge transfer development capability
		Corporate university
		
		Create, renew build and organize knowledge assets
		
		Discover & innovate constantly
		Acquire knowledge
		Educate & train
		Maintain knowledge bases
		Automate knowledge transfers
		Conduct research and development
		Transform and embed knowledge
		
		Distribute and apply knowledge assets effectively
		
		Always use best knowledge
		Share knowledge throughout enterprise
		Collaborate to pool appropriate knowledge
		Adopt best practices
		Sell products with high knowledge content
			Mentoring, Training and Development, A Knowledge Project, A Knowledge Repository, Communities of Practice, Intermediary Roles, Storytelling, Collaboration, Social Network Analysis, Scenarios, Knowledge Mapping, Experiments

Author	Ismail & Yusof (2008)	Neagu (2008)	King (2009)
Components	**Cultural Factors:** Sociability, Solidarity, Power Distance **Technological Factors** Availability of IT infrastructure, Availability of IT for KS, Expert vs. distributed Model, Problem of codification **Communication Factors** Trust, Face-to-face interaction, Reciprocity, Repute, Altruism, Acknowledgement **Organizational Support Factors:** Management Support, Rewards, Mentoring, KS to be included as part of work process	**Socialization** Apprenticeship, Shared experiences, On-the-job training, Joint Activities, Physical proximity, Walking in the company, Informal meetings outside the workplace, Wandering outside the company **Externalization** Use of metaphors and analogies, Dialogue, Self-reflection **Combination** Use different data sources, Meetings and telephone conversations, Presentations, Using ICTs **Internalization** Learning-by-doing, Focused training with senior colleagues, Simulation/experiments, Self-reflection upon documents, Reflection with others	**Creation** Socialization, Externalization, Internalization, Combination **Acquisition** Search, Sourcing, Grafting **Refinement** Explication, Encoding, Culling, Cleaning, Indexing, Standardizing, Organizing, Distilling, Integrating, Revising, Evaluating for appropriateness, Pruning, Selection for inclusion in memory **Storage** **Transfer** **Sharing** **Utilization** Elaboration, Infusion, Thoroughness (to facilitate), Innovation, Individual Learning, Collective Learning, Collaborative Problem-Solving, Embedding Knowledge, Creating Dynamic Capabilities, Knowledge Re-Use

Author	Carrillo (2004)	Carrillo (2004)	Neagu (2008)
components	**Create knowledge** **Non-IT tools** Conferences CONRAD Customized training programmes Technology planning process Tours to reputable universities and companies University-based research projects War room **IT Tools** Discussion boards Margin model (data warehousing software) Patent search engines (for data mining) Subscriptions to various corporate intelligence sources on the internet **Share knowledge** **Non-IT tools** Career dialogues 'Cold eyes' review Communities of practice Expertise database (skills yellow pages) Lessons learned Mentoring Networks/decision teams Performance diamond Project management systems Succession planning Technical forum Technical peer assist Tutoring **IT Tools** Autonomy FileNet (document management system) Game Changer IMACS LiveLink Lotus Notes NewsEdge PEARL	**People-centred** Expertise database, communities of practice, technical forum, Expertise database and communities of practice, Succession planning and lessons learned, Succession planning, lessons learned, cold eyes' review, communities of practice, Tutoring and succession planning **People-centred & IT-centred** Expertise database, threaded discussion, Intranet, Electronic, Document Management System **IT-centred** Range of IT tools for sharing knowledge	**Socialization** Groupware, Expertise location, Knowledge Map Systems, Visualization tools, Instant Messaging, Email, Knowledge Portals **Externalization** Groupware, Newsgroups, Forums, Instant messaging, Email, Workflow systems, Artificial Intelligence, Knowledge Portals **Combination** Search Engines, Workflow, Innovation Supporting Tools, Competitive Intelligent tools, BI (Business Intelligence), Document and content management systems, ERP Systems, Intranet, Voice / Speech Recognition, Search Engine, Taxonomy, Knowledge Portals **Internalization** e-Learning, Computer Based Training, Innovative supporting tools

Author	Alavi & Leidner (2001)	Alavi & Leidner (1999)	Alavi & Leidner (1999)

Components	**Knowledge Creation:**
	  Data mining
	  Learning tools
	  Combining new sources of knowledge
	  Just in time learning
	
	Knowledge Storage/Retrieval
	  Electronic Bulletin Boards
	  Knowledge Repositories
	  Databases
	  Support of individual and organizational memory
	  Inter-group knowledge access
	
	Knowledge Transfer
	  Electronic bulletin boards
	  Discussion forums
	  Knowledge directories
	  More extensive internal network
	  More communication channels available
	  Faster access to knowledge sources
	
	Knowledge Application
	  Expert systems
	  Workflow systems
	  Knowledge can be applied in many locations
	  More rapid application of new knowledge through workflow automation
		Information-based
		  External:
		    Client information
		    Competitive information
		    Customer information
		    Market information
		  Internal:
		    Activity-based costing
		    Financial information
		    Human resources information
		    Product/Services information
		
		Technology-based
		  Integrated databases
		  Interoperability of existing systems
		  Larger bandwidth
		  Global IT infrastructure
		  Intelligent agents
		  Consistent suite of email and web products
		  Navigational tools
		  Fast retrieval
		
		Culture-based
		  Teamwork
		  Practical guidelines
		  Knowledge sharing
			Information-based
			  Actionable information
			  Categorizing of data
			  Corporate yellow pages
			  Filtered information
			  Free text and concepts
			  People information archive
			  Readily accessible information
			
			Technology-based
			  Data mining
			  Data warehouses
			  Executive information systems
			  Expert systems
			  Intelligent agents
			  Intranet
			  Multimedia
			  Search engines
			  Smart systems
			
			Culture-based
			  Collective learning
			  Continuous learning
			  Intellectual property cultivation
			  Learning organization

Appendix 2: e-Business Models

Author	Rappa (2002)	Julta et al. (2001)	Applegate (2001)	Timmers (1998)
Components	Focused distributor, Retailer, Marketplace, Aggregator, Infomediary, Exchange, Portals, Horizontal portals, Vertical portals, Affinity portals, Producers, Manufacturers, Service provider, Educators, Advisors, Information and news, Infrastructure distributors, Infrastructure retailers, Infrastructure marketplaces, Infrastructure exchanges, Infrastructure portals, Horizontal infrastructure portals, Vertical infrastructure portals, Infrastructure producers, Equipment/component, manufacturing, Software firms, Custom software and integration & Infrastructure provider	**Agents** (Research and Analysis, Content Management, Sales, Marketing and Service, Community, Education and Entertainment) **Community** (Engage, Community Interaction, Community Services, Community Governance) **Customer** (Engage, Order, Fulfilment, Support) **Governance** (Socio / Economic (Stability of Geographic Area), Marketplace rules (Stability of the Market), Privacy /Trust (Stability of the Customer), Technological (Stability of the Architecture)) **Internal Operations** (Productivity, e-Culture, Information Systems Infrastructure and Services) **Operational Partner** (Contracts Management, Identification Mechanism, Assurance, Dispute Resolution, Relationship Management, Transaction Management, Content Management, Intellectual Asset Management **Strategic Partner** (New Alliances, Account Planning, New Market Research, Macro Resource Planning, Product or Service Development	Brokerage, Advertising, Infomediary, Merchant, Manufacturing, Affiliate, Community, Subscription & Utility	e-shop, e-procurement, e-auction, e-mall, Third party marketplace, Virtual communities, Value chain service provider, Value chain integrators, Collaboration platforms & Information brokerage

Author	Rappa (2004)	Lowry (2002)	Damen (2002)
Components	**Brokerage** (Marketplace Exchange, Buy/Sell Fulfilment, Demand Collection System, Auction Broker, Transaction Broker, Distributor, Search Agent, Virtual Mall) **Advertising** (Portal, Classifieds, Registered User, Query-based Paid Placement, Contextual Advertising, Content-Targeted Advertising, Ultramercials) **Information Intermediary** (Advertising Networks, Audience Measurement Service, Incentive Marketing) Merchant (Virtual Merchant, Catalogue Merchant, Click and Mortar, Bit Vendor) **Manufacturer Direct** (Purchase Model, Lease Model, Licensing Model, Brand-Integrated Content) **Affiliate** (Banner Exchange, Pay-per-Click, Revenue Sharing) **Community** (Open Source, Public Broadcasting, Knowledge Networks) **Subscription** (Content Service, Person-to-Person Networking Service, Trust Service, Internet Service Provider) **Utility** (Metered Usage, Metered Subscription)	**Cataloging** (Product Description & Inventory Management) **Pricing** (Pricing Models, Discounts & Negotiations) **Marketing** (Advertising, Loyalty Programs & Market Research) **Shipping** (Delivery Orders, Shipping Instructions & Bill of Lading) **Requisition** (Request for Quotes & RFQ Processing) **Payment** (Invoicing, Terms & Conditions Settlement) **Order** (Purchase Order & Credit Authorization) Customer Information Support (Customer Profiling & Customer Service) **Market Exchange Mechanism** (Auction Mechanisms, Price Selection & Bid Processing)	**e-Procurement** (Supply Chain Management, e-Commerce (Customer Relationship management) **e-Collaboration** (LiveLink (video Conference), Collaborative Engineering with Clients, internal collaboration, e-Business support processes (e.g. e-HR, e-Travel Management), e-Business enabling processes (e.g. e-Registration Content Management, e-Payment) **Knowledge Management** (Customer Data Library, Lesson Learn Data Base, Bid Library, Obelix project Data Base) **Industry Portal** (Online Simulation, Cluster Assessment, Online Questionnaire, Training and Operational Support Selling)

Author	Porter 2001 Jelassy & Enders (2005)	Chateau (2000)	Daughfous (2006)
Components	**Firm infrastructure:** Web-based, distributed financial and enterprise resource planning (ERP) systems Online investor relations (e.g. information dissemination, broadcast conference calls) **Human resource management:** Self-service personnel and benefits administrations Web-based training Internet-based sharing and dissemination of company information **Technology development:** Collaborate product design across locations among multiple value-system participants Knowledge directories accessible from all parts of the organization Real-time access by R&D to online sales and service information **Procurement:** Internet-based demand planning Other linkage of purchase, inventory and forecasting systems with suppliers Direct and indirect procurement via market place, auctions & buyer-seller matching **Inbound logistics:** Real-time integrated scheduling, shipping, warehouse management, demand management and planning, and advance planning and scheduling across the company and its suppliers Dissemination throughout the company of real-time inbound and in-progress inventory data **Operations:** Integrated information exchange, scheduling and decision-making in in-house plants and components suppliers **Outbound logistics:** Real-time transaction of orders Automated customer-specific agreement and contract terms Customer and channel access to product development and delivery status Collaborative integration with customer forecasting systems Integrated channel management **Marketing & sales:** Online sales channels including websites & marketplaces Real-time inside and outside access to customer information, product catalogues, dynamic pricing, inventory availability, online submission of quotes and order entry Online product configurations Customer-tailored marketing via customer profiling **After-sales service:** Online support of customer service representatives Customer self-service via websites and intelligent service request processing	**Sourcing (suppliers):** Professional purchasers who buy abroad and directly from vineyards: no wholesalers or importers involved **Warehousing & logistics** Danzas inbound shipping Hays inventory and service platform; all in Paris **Marketing & content** Little site customization except from central team 1-3 people localize sites for content, pricing, site texts and product range Local PR partnering and alliance management Outsourced PR banner campaigns Referencing Buttons on partner sites Web-miles e-Newsletter Deutsche BA frequent flyer club **Sales & payment:** Effective purchasing but with complex add-ons (vouchers, promotional codes, etc.) SuperMut security from Credit Mutual **Deliver & procurement:** Outsourced to UPS across EU and Switzerland Break-even service where small orders subsidize large ones and cities subsidize remote delivery 95% of deliveries are on time **Customer service:** Multilingual call centre based in Paris Usually e-mail but will call on critical occasion to rearrange shipping **After-sales (repeat):** e-Newsletter (reminders)	**e-business skills & knowledge:** Customer service Knowledge about e-business Information technology skills Marketing skills **Managerial systems:** Supply chain management Inventory management Knowledge management Training R&D Human resources Redesign of business processes Distribution and logistics Disaster recovery planning **Physical systems:** ERP Systems Legacy applications Web site and intranet Financial systems Factory equipment and production techniques Networks **Culture and values:** Executive commitment Alignment of e-business of business strategies Level of risk Change management Sharing and collaboration Responsibility awareness

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Author	Lin (2008)	Miler (2001)	Jelassy & Enders (2005)
Components	**Extent of internal integration:** Accounting and financial management. Material and inventory control. Order processing and fulfilment. Sales force automation. **Extent of external diffusion:** Enables the exchange of operational data with suppliers. Enables the exchange of operational data with business customers. Facilitates shipment and logistics management with suppliers. Facilitates the customer service support.	**Supply Chain Management** Procurement Transportation Management Warehouse Management Manufacturing/Operations **Back Office** Human Resources Finance Information Technology Engineering **Customer Relationship Management** Marketing Sales Customer Service Market Intelligence	**Product development:** Virtual project workplace Product structure management Interactive modelling and analysis **Procurement:** Engineering change management Quote management Auctions Catalogue Asset management **Supply chain management:** Supply connect Asset management Inventory management Demand fulfilment visibility

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Author	Ash & Burn (2003)	Vassilopoulou et al. (2003)	Lin (2011)	ALhawamdeh (2007)
Components	**Customer interaction:**	**Individual**	**Business technology:**	**IT capabilities:**
	Customised solution	Geographic	Planning new IT infrastructure and architecture	**e-Commerce:** buying and selling
	Knowledge empowered services	Culture	Aligning and integrating emerging IT applications with business operations	**Business processes:**
	Service experience	Education & Experience	Enabling the new IT to deliver novel process and coordination services	Serving customers/suppliers and managing their relationships electronically (e-CRM)
	Information & communication technology:	Transactional	Managing the sourcing of the new IT	Managing all supply activities till delivering products/services to customers (e-SCM)
	Autonomous software agents	Psychological	Ensuring IT and information security	Internal communication between employees
	Intranet value chain	Behaviour	**Business management:**	External collaboration with other business partners
	Internet site value	Individual Differences	Fostering business agility and market responsiveness	
	Asset sourcing:	Demographic	Identifying customer value propositions	
	Resource alliances	**Technical**	Reinventing business models	
	Asset leverage	Service Performance	Developing enterprise absorptive capacity	
	Efficient sourcing	Commitments	**Collaboration:**	
	Knowledge leverage:	Integration	Developing partnerships	
	Individual expertise	Internal IS-Platforms	Governing the value network	
	Organization expertise	Generic Business	Enabling open innovation	
	Community expertise	Services	Improving co-production and co-creating value	
		Interoperability & Interconnectivity		
		Industrial		
		Product		
		Characteristics		
		Type of Industry		
		Suitable Cooperation		
		Partners		
		Competition		
		Industry Structure		
		Customers		
		Social		
		Geographic		
		Cultural		
		Economic		
		Legal / Regulation		
		Ethical & professional		
		Social Capital / Social Network		
		Organizational		
		Product		
		Characteristics		
		Management & Structure		
		Market & Customers		
		Resources & Capabilities		
		Partnerships		
		Efficiency		
		Organizational		
		Culture		

Appendix 3: Interview Questionnaire

UNIVERSITY OF LIVERPOOL

Interview Questionnaire

Individual Information

Name: --

Position (in company): --

Company Name: ---

Telephone Number: --

e-Mail: --

Address: --

Company Information

Vision: --

Mission: --

Objectives: --

Strategies: ---

Amount of company's personnel: ---

Amount of company's subsidiaries: ---

The most important successes of company with your management ---------------------------------

Do you think you have achieved your objectives in company? ---------------------------------------

----

Main Research Questions

1) e-Business:

1-1) Philosophy and Objectives:

- *What is your definition from e-business?*
- *What is e-business strategy in your company?*
- *What plans have been in place or in the horizon for that?*
- *What investments have been made (or to be made) in this field?*
- *Extent of e-business implemented in your company?*
- *Your overall impression of it Success or failure?*
- *What functions/activities (organisational objectives) have been (to be) covered by e-business in your company?*
- *What is your required key knowledge and information (vital for succeeding in your activities in your company) going to be handled in your e-business? (e-commerce; SCM/Logistics; CRM; COPs; …)*
  - *Who are your internal stakeholders and what is information exchange between your company and them?*
  - *Who are your external stakeholders and what is information exchange between your company and them?*
- *E-Business Technology:*
  - *Have you acquired or access to the required technology? Any issues?*
    - *What are the needed Tech and their features?*

1-2) Results:

- *e-Business to shape social or professional networks in your company: (Required? Possible? Achieved? Issues?)*
- *e-Business to enhance the integration of your company's activities with the stakeholders? (Required? Possible? Achieved? Issues?)*
- *e-Business to facilitate the knowledge communications in your company? (Required? Possible? Achieved? Issues?)*
- *e-Business to improve efficiency in saving time and reducing cost? (Required? Possible? Achieved? Issues?)*
- *Success or failure of your e-Business plans/systems? Why?*

1-3) Barriers:

- *What are the barriers if you like to implement e-business at Individual, Organizational and Technological levels?*

2) Knowledge Management (KM):

2-1) Philosophy and objectives:

- *What is knowledge to/for your organisation? Why is important (if it is)? (Survival/competitiveness/growth/…)*
- *Is managing knowledge something your organisation cares about and does? How serious?*
- *What is your definition from KM?*
- *What is KM strategy in your company? (if exists! If not why?)*
- *What have been or are the plans for that?*
- *What investments have been made (or to be made) in this field?*
- *Extent of KM implemented in your company?*
- *Your overall impression of it Success or failure?*
- *What functions/activities (organisational objectives) have been (to be) covered by KM in your company?*
- *How does the required key knowledge collect, distribute and exploit between your division and other divisions?*
- *What is the process of KM and KM system in your company?*
- *Does your company have the required technology for KM system?*

2-2) B2)Results:

- *KM to shape social or professional networks in your company: (Required? Possible? Achieved? Issues?)*
- *KM to enhance the integration of your company's activities with the stakeholders? (Required? Possible? Achieved? Issues?)*
- *KM to facilitate the knowledge communications in your company? (Required? Possible? Achieved? Issues?)*
- *KM to improve efficiency in saving time and reducing cost? (Required? Possible? Achieved? Issues?)*
- *Success or failure of your KM plans/systems? Why?*

2-3) Barriers:

- *What are the barriers if you like to implement KM at Individual, Organizational and Technological levels?*

3) Aligning e-business and KM:

3-1) Relationship:

- *How do you see KM and e-business to relate each other in your company?*
  - *Has it been thought of, planned, or done?*
    - *Any experience in co-development of KM and e-business or failure of them due to misalignment?*

3-2) Results:

- *How do you see the result of such alignment or misalignment on strategic capabilities? Efficiency? And organizational performance?*

3-3) Barriers and drivers:

- *What issues/barriers have affected the alignment negatively?*
- *What drivers have affected the alignment positively?*

4) e-Enabled Knowledge Network:

- *Do you recognise such networks in your organisations?*
- *If yes, what does it mean to your organisation?*
  - *Features?*
- *Any experience, success stories or otherwise?*
  - *If succeeded; do you associate it with how your e-Bus and KM have been developed and aligned?*
- *Impacts of this (if achieved) on: (to get some real examples and stories regarding the impacts)*
  - *Organisation's capabilities (should define for them)*
    - *To create value and exploit market opportunities*
    - *To respond to market and environment changes in an agile manner*
    - *To become a learning organization*
      - *Increase of organizational absorptive capacity*
    - *To become an innovation led organization*
      - *Increased rate of new product development and introduction*
    - *To become resilient to unexpected changes (threats and crisis)*
  - *Organizational Performance*
    - *Increase customer's satisfaction*
    - *Meet and exceed market share*
    - *Reduced cost of operations*
    - *Increased sales and profits*
    - *Reduced time of operations and new product introduction*

Appendix 4: The Designed Models via Nvivo

content &
process of e-
business model

Technology Adoption

K-based Integrated
Networks

e-Business Strategy

e-Enabled Knowledge Networks

Strategic Capabilities

Organisational Performance

KM Strategy

Networked Knowledge

Technological

Organisational

Individual

Content &
Process of km
model

KM System

Research Model