# Dynamics of Knowledge Management and Innovation Focus of Software Firms: A Developing Country Perspective

Susantha Udagedara R.M.U and Kurt Allman

**Abstract:**

This study examines how the knowledge management dynamics affect the adoption of innovation in software firms using the residual-dominant and emergent theoretical framework as the existing innovation theories, which are based on life cycle theories do not provide deep insight into the effect of past, present and emerging knowledge management practices on innovation adoption decisions. The findings emphasise the importance of analysing the dominant knowledge management (KM) practices as well as the residual and emerging knowledge management practices to identify the knowledge management specific enablers and barriers to innovation when business firms move from one stage to another stage as they have to develop, recreate and sustain their knowledge capabilities to enhance business performance through innovation. The study revealed that the knowledge focus changes in line with the innovation focus.

**Keywords:** Knowledge Management Dynamics, Innovation, Firm Life cycle, Software Firms

## Introduction

Based on creative disruptive view of Schumpeter (1934), Kirchhoff et al (2013) argue that technology based innovative start-ups trigger wealth creation, economic growth and regional development. In developing countries, however, unfair competition, lack of financial support, laws and regulations, tax burden and lack of national innovation support systems discourage growth and innovation capacity of small technology based firms (Hadjimanolis, 1999. Zhu et al, 2012). The knowledge based view (KBV) of the firm assumes that firms with unique knowledge management practices can overcome most of these barriers (Spender, 1996; Teece, et al, 1997). Despite the contribution of technology based SMEs at both regional and local level to economic growth, how technology based small firms in developing countries undertake innovative activities and use knowledge remain unclear. Therefore, in this study we focus on investigating, how technology based small firms in low income countries(LICs) acquire, store and disseminate knowledge to innovate when they start up, grow and mature as researchers have paid less attention to examine this phenomena.

It is argued that knowledge and technological capabilities plays a vital role when innovative products are introduced in the global market, and at the same time this becomes a challenge for any firm, especially small- and medium-sized enterprises (SMEs) (Tidd et al., 1997). This is because large firms employ more resources and are in a good position to innovate although some studies argue that small firms may benefit from other advantages such as flexibility (Rogers, 2004). Regardless of size, firms in low income countries face more barriers in comparison to the firms in the developed world. Especially firms in developing countries struggle to learn and acquire new knowledge. Hence, the success of firms in LICs and their capacity to innovate largely depend on the ability to learn and use new knowledge (Larsson, Bengtsson, Henriksson, and Sparks, 1998).

As indicated by Galliers and Newell (2000), knowledge is viewed as self-contained truths, and as many writers in the innovation literature indicate, knowledge is also a

central aspect of innovation (Charterina and Landeta, 2013; Zahay et al., 2011; Coopey, 1995; Leonard-Barton, 1992). Nonaka and Takeuchi (1995) stated that the innovation capability of an organisation is critically dependent on the ways and means by which the organisation explores and exploits new information. And Cohen and Levinthal (1990) previously argued that the absorption and utilisation of new information provides the conditions required for innovation. More recently, Denning (2013) pointed out that new knowledge on new approaches like agile methods influences innovation. This view is also supported by the role of dynamic capabilities, which allow firms to adapt to various environmental forces and changes (Teece et al., 1997; Teece, 2007). However, issues of learning, KM practices and technology efforts at the firm level remain largely unknown (Morrison et al, 2008). More precisely, we noticed that how firms use their Knowledge Management capabilities to support innovation at different stages of small technology firm development within the context of developing countries remain as overlooked area in the existing innovation management literature. In this study, we therefore fill this gap by investigating the evolution of KM practices and innovations of software companies in Sri Lanka.

**Theoretical Background**

As noted by Washo and Faraj (2000), knowledge can be codified, stored and shared. Therefore, it is viewed as an asset. According to Nonaka and Takeuchi (1995:58), "knowledge is created by the flow of information, anchored in the beliefs and commitment of its holder". This suggests that knowledge is dynamic, humanistic and relative (Nonaka et al., 2001). Smith et al (2008:7) refer to knowledge management as being "the management and utilisation of knowledge for innovation management". Their definition covers all aspects of knowledge including internal and external knowledge and also organisational learning. Moreover, they discuss KM activities in connection with innovation management. Following this line of thinking, within this study, knowledge management (KM) refers to the management and application of all types of knowledge for the development and implementation of innovation. It takes into account both internal and external knowledge and organisational learning required for innovation as discussed by Smith et al. (2008).

Knowledge can be divided into two categories, tacit and explicit (Polanyi, 1962, 1966). Tacit knowledge is deeply rooted within individuals and is hard to separate from its original source due to its complex and unique nature. Explicit knowledge represents the other side of the coin as it can be stored in documents or organisation databases which are more formal in nature and easy to share across the organisation (Nonaka and Takeuchi, 1995). Although it is hard to store and transfer, the exchange of tacit and explicit knowledge brings benefits to both employees and organisations (Song, 2002; Nonaka and Takeuchi, 1995). Lam (2000) and Howells (1996) found that tacit knowledge plays a critical role in shaping innovation. However, Hall and Andriani (2002) argue that it is essential to achieve a balance between tacit and explicit knowledge in order to gain the advantages that allow for innovation.

Knowledge management (KM) is a systematic and organisation-specific process (Heavin, 2012). It involves a broad range of activities, which include the acquisition, sharing and preservation of knowledge that assists the organisation to adapt, innovate and achieve its desired targets (Heavin, 2012; Desouza and Awazu, 2003). Some scholars, like Leonard (2003), view knowledge management as a progression strategy as it provides a basis for competitive advantages. The effectiveness of knowledge

management practices is determined by three important dimensions as discussed by Lam (1997, 2000). This includes the central aspects of knowledge in use, the effectiveness of knowledge dissemination and applications within organisation, and the co-ordination and knowledge-transferring practices. Lundvall and Johnson (1994:23-42) described four dimensions of economic knowledge as follows:

(1) Know-what. This is described as the specific factual information that is relevant in specific areas of expertise, and firms tend to obtain this through social networks such as suppliers, customers, etc.

(2) Know-why. This is described as the basic scientific knowledge that is vital for innovative efforts.

(3) Know-who. This is related to the specific and selective knowledge that is embodied in the key individuals who assist interactive learning and problem-solving within the organisation.

(4) Know-how. This is described as the practical skills and capabilities that are linked to the production capabilities, marketing etc.

Grant (1996) argues that the success of a firm is dependent on its ability to integrate the knowledge possessed by the different individuals who develop services and products. And it is accepted that the required creative capabilities generally exist in the internal as well as the external environment (Savage, 1990). The knowledge utilised for innovation is not a result of disconnected events arising from one person but rather the outcome of interactions that develop through formal and informal relationships, which are themselves essential elements of knowledge and innovation (Kline and Rosenberger, 1986). Lundvall (1988) mentioned that learning arises from internal and external sources of knowledge and when people use, apply, and share that knowledge.

The literature suggests that a firm's ability to innovate is influenced by external knowledge (Garriga et al., 2013; Lawson et al., 2009; Rosenkopf and Nerkar, 2001; Cohen and Levinthal, 1990), but that even when a firm does not adjust its knowledge searching strategy, a knowledge-rich environment still has the ability to generate innovation (Garriga et al., 2013). However, it is recognised that developing links with external parties is vital for innovation as such networks can expose firms to unexpected knowledge (Jiang and Li, 2009; Jordan and Segelod 2006; Dyer and Singh, 1998), and Von Hippel (1989) earlier found that the knowledge of suppliers and customers has a direct impact on innovation. Allen (1983) even argued that even competitors may contribute to the innovation within a rival organisation. In fact, Harhoff et al. (2003) believe that partnering with competitors can have a significant effect on innovative performance. Indeed, Jiang and Li (2009) and Ahuja and Katila (2004) found that firms that develop external network relationships demonstrate high innovative performance. Undoubtedly, all this evidence over a long period of time confirms the vital role played by external knowledge in shaping innovation.

If organisations are able to enhance the learning and knowledge of their human capital, their ability to adapt to changing environments and to innovate becomes much easier (Nonaka and Takeuchi, 1995). Therefore, more attention should be paid towards

developing a learning-friendly working environment (Chen and Huang, 2009; Carneiro, 2000). In this regard, the link between organisational culture and learning is nothing new. How employees perceive their work environment is often associated with their approaches to learning (Kirby et al., 2003) and individual and team learning (Janz and Prasarnphanich, 2003; Alavi and Leidner, 2001). The literature suggests that if risk-taking is rewarded and there is an acceptance that mistakes and failure can represent learning, both individual and collective learning are more likely to take place. However, if there is a culture of fear and recrimination, learning is hindered as individuals become reluctant to voice worries about problems and become concerned with covering up mistakes (Elliott et al., 2000). As Hodgkinson and Wright (2002) found, defensive routines within the top team can jeopardise organisational learning. This confirms earlier assertions within this chapter that organisational knowledge and learning is directly influenced by the organisational culture.

As Moran and Ghoshal (1996) stated, three conditions must be satisfied to support organisational learning. The first condition is the ability to access different sources of knowledge, which is imperative to combine and exchange information. There is no doubt that gaining access to different knowledge sources is an obvious starting point although less research attention has been directed towards this particular issue (Tsai, 1998, 2000). Alavi and Leider (2001) also stressed the importance of facilitating collaborative learning in order to encourage knowledge sharing (KS). The second condition is that the exchange and combination of knowledge by different parties should be an effective and useful activity; and the third important condition is that participants must be motivated, and feel that the outcome is of value to both the organisation and themselves (Moran and Ghoshal, 1996).

In addition to these three conditions, Nahapiet and Ghoshal (1998) suggest a fourth condition required for effective organisational learning, arguing that even if all three conditions already identified are satisfied, the combination and exchange of knowledge will not occur if the parties involved do not possess the required capabilities, as capabilities are necessary elements of the learning process (Tsai, 2000). Cohen and Levinthal (1990) also emphasised the importance of capabilities not only to recognise the knowledge but also to assimilate and use it. Coopey (1995) and Coopey and Burgoyne (2000) argue that power and politics within organisations plays a vital role in determining access to knowledge. The majority of the literature acknowledges learning as a beneficial process to both individuals and organisations, but it has been argued that sometimes learning can be dysfunctional (March, 1991). If learning is affected by misunderstanding and defensive routines, then it can lead to a distorted type of learning (Argyris, 1993), and the reasons for this can be factors such as scapegoating, inadequate regulations, enforcement, and poor problem definition.

According to Argyris and Schon (1978), many organisations fail to maintain a balance between existing knowledge-preservation activities and new knowledge-creation activities because of ‘limited learning systems’ that conceal errors and encourage organisational defensive patterns. Organisational defensive patterns are mechanisms adopted automatically to protect individuals and groups from painful and threatening information (Probst and Buchel, 1997; Argyris, 1993). Storey and Quintas (2001) argue that failure to consider the human dimension of knowledge sharing can deter learning within organisations. Learning is only effective when it results in behavioural

change, and there can be no learning without action and no action without learning (Revans, 1998).

As discussed by Newell and Swan (2000), learning does not result only through the acquisition of new programmed knowledge, regardless of the importance of that knowledge to organisational operations. Effective learning only happens when the organisation has a supportive culture and sound managerial practices (Skerlavaj et al., 2010; Heo, 2008). It is attributed to a long-term process which enhances organisational skills in creating, acquiring, and transferring knowledge (Zack, 1999). Another important aspect required for effective learning is the empowerment of employees to make decisions based on the knowledge and skills that they acquire and this necessitates trust (Newell and Swan, 2000).

Knowledge sharing (KS) is considered as one of the important issues affecting innovation (Heavin, 2012; Amalia and Nugroho 2011; Zahay et al., 2011; Saenz et al, 2009; Smith et al 2008; Scarbrough, 2003; Calantone et al., 2002). Organisations use various ad hoc mechanisms for KS including information and communication technologies (Davenport, 2007; Dalkir, 2005). Wiig (2004) argues that people interaction is key for KS as it is implicitly a social activity that involves the exchange of employee knowledge, experience and skills, thus demanding social networks (Hogel et al., 2003). A firm that focuses on enhancing KS needs to incorporate a KS culture in its business strategy while taking action to change the behaviour and attitudes of employees (Lin and Lee, 2006; Connelly and Kelloway, 2003). Hence, employee motivators, organisational environment, information and communication technology (ICT) applications, all play a significant role in KS (Zahay et al., 2011; Lin and Lee, 2006; Wasko and Faraj, 2005). Among many other factors, individual characteristics such as willingness to share knowledge, have a direct effect on innovation (Wasko and Faraj, 2005). Another important aspect is the organisational culture since a culture that promotes KS and innovation is imperative (Skerlavaj et al., 2010; Heo, 2008; Saleh and Wang, 1993). Rewarding, and effective leadership and management support can be seen in KS- friendly working environments (Chen and Huang, 2009; Song, 2002). At the same time in order to facilitate communication, online databases, virtual communities, and intranets are used by many firms for KS (Koh and Kim, 2004).

Utterback and Abernathy (1975) stated that firms adopt different type of innovation over time. Barras (1990) found that the type of innovation adoption follows a process –product pattern in services. On the contrary, Utterback and Abernathy (1975) found that the product-process innovation pattern is more common in business firms. Damanpour and Gophalakrishnan (2001) also confirmed that the product-process innovation pattern is more common in business. Using different types of innovation, Koplyay et al. (2013) suggest that the management focus follows a pattern of product, marketing, process, and finance innovations. All these studies have relied on life cycle theories but they have ended up with differing views as the types of innovation used in these studies are different from one study to another. This study adopted the four types of innovation suggested by the OECD (2005) and earlier by Schumpeter (1934), since this model minimises the diverging views among practitioners and academics. The OECD defines innovation as follows:

*"A product innovation is the market introduction of a good or service that is a new or significantly improved good with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components, and materials, incorporated software, user friendliness or other functional characteristics" (OECD, 2005:48).*

*"Process innovation is the implementation of a new or significantly improved production process or distribution method. This includes significant changes in techniques, equipment and or software" (OECD, 2005:49).*

*"A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing" (OECD, 2005:49).*

*"An organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations" (OECD, 2005:51).*

Whilst there is an abundance of literature concerning the general aspects of KM, few scholars have paid attention to the role of knowledge and learning at different stages of organisational development. Of those who have, Audretsch and Feldman (1996) argue that tacit knowledge becomes dominant at the early phase of organisational development, and as noted by Cohen and Klepper (1992), in small organisations this occurs because there is less incentive to invest in R&D activities than there is in large firms. As West III and Noel (2009) discuss, knowledge capabilities determine the existence of firms and provide the initial foundation for competitive advantages. Breslin and Jones (2012) argue that entrepreneurial learning evolves overtime and shapes organisational knowledge. Sharma and Salvato (2011) state that at the early stages, firms rely more on founders' capabilities and knowledge of trusted networks. As Knight (1989) found, start-ups lacked market research and other administrative skills required for environmental scanning and analysis. Cope (2005) argues that entrepreneurs learn key skills through a process of learning by doing at the early stages. Therefore, knowledge is shaped through the experience of trial and errors (Breslin and Jones, 2012; Gibb, 1997). Morrow et al. (2007) argue that at the early stages, firms have to access external sources to develop required capabilities. Utterback and Abernathy (1975) note that firms focusing on product innovation at the early stages of their development are driven by new market perspectives, and at this point, they tend to obtain the essential insight by studying the relevant attributes of the product rather than using scientific results or advanced technologies, and consequently it is unfamiliar sources that play the key role in shaping innovation (Utterback and Abernathy, 1975). At this stage, individuals who are familiar with market needs or customer inquiries occupy the significant role in developing innovation, and hence, innovation is in the hands of experience individuals rather than produced by teams (Zahra et al., 2009). If advanced technology is required, it is applied to product rather than process innovation (Utterback and Abernathy, 1975). As West III and Noel (2009) discuss, in a start-up firm, CEO or founder becomes the main sources of knowledge and they generally attempt to learn about market opportunities. At this stage, the development of business is dependent on the ability to build new knowledge and knowledge capabilities provide the initial foundation for competitive advantages for a start-up.

Utterback and Abernathy (1975) also stated that in their research, there were relatively few small firms, or older firms entering a completely new market based on their existing technological strengths. Innovations also come from those individuals who have the experience of needs and are thus familiar with them. Scott and Bruce (1987) argue that at the early stages, firms require administrative knowledge and skills which creates demands on the manager who may not possess those attributes or quite simply may not want to use them. Thus, it is essential either to change the prevailing management style, or acquire the required skills from elsewhere in the early stages of development (Zahra et al., 2009).

At the growth stage, firms attempt to increase their sales and focus on differentiating their products due to increasing competition (Scott and Bruce, 1987). As West III and Noel (2009) noted, at the later stages, firms gradually gain knowledge through networking and such practice assists innovation activities. Utterback and Abernathy (1975) argue that at this point in organisational development, the focus is on obtaining and applying advanced technology as firms attempt to differentiate their products from those of their rivals by process improvements. The use of the product is increased and the market uncertainty for it is reduced as the product achieves greater diffusion. As Kotha et al., (2011) found, at the later stages, firms tend to enhance their technological capabilities to increase the quantity of innovative output. Firms try to replace an existing product using advanced technologies rather than creating an entirely new product. The application of advanced technology to standardise products is critical because of the increasing demand and competition which forces the firms to innovate in process terms, and increase their output whilst differentiating their offerings (Utterback and Abernathy, 1975). Hence the focus is on developing methods that support process improvement and on using advanced technologies.

In the research conducted by Utterbak and Abernathy (1975) into five different industries found that efficiency and economies of scale were emphasised in production at the third stage. Firms, therefore, display a strong focus on cost-minimisation and improving efficiency. At this stage, scientific results and new techniques are critical for the firm's success and attempts are made to obtain this knowledge by linking with universities and other research institutions (Utterback and Abernathy, 1975). Chiaroni et al. (2010) and Bercovitz and Feldman (2007) state that universities have become a favourable source to access scientific and technical knowledge required to implement successful innovation. Moreover, universities are considered as less risky long- term partners in terms of potential spillovers (Chiaroni et al., 2010). Scott and Bruce (1987) stated that in the later stages, firms struggle to manage growth and control operations, and that most of them face administrative, business expansion, and market-related issues. Therefore, firms actively seek new managerial approaches and external knowledge as they concentrate on expanding business, plant upgrading, and productivity improvements (Scott and Bruce, 1987).

As Chiaroni et al. (2010) discuss, in the later stages, new organisational roles are introduced to monitor the development of technologies and scientific advances and in particular, firms appoint gatekeepers to administer and streamline knowledge and innovation activities. A review of the software-related literature also suggests that at the later stages, software firms look for relationships with outside parties as they attempt to standardise their products (Alajoutsijarvi et al., 2000). Zahra et al. (2009)

state that in the later stages, firms build new knowledge and replace the dated capabilities by accessing multiple sources of knowledge.

One notable fact is that innovations models which are based on life cycle theories limit innovation to a specific number of stages such as three, four, or five stages, creating disagreement and debate among life cycle theorists (e.g. Scott and Bruce, 1987; Quinn and Cameron, 1983), and ignore the interaction of different stages of organisational development. As a result, simple and sequential stages theories fail to investigate the complex and dynamic nature of innovation and effect of KM practices on innovation (Wolfe, 1994, Schroeder et al., 1989). Afuah (2003) classified models of innovation management into two major categories, static and dynamic. Static models do not conceptualise how innovation evolves over time, whereas dynamic models incorporate the effect of time in the innovation process. The models that follow the antecedents approach are found to be more static and do not incorporate change in innovation and the changing nature of innovation-influencing factors at various stages of organisation development. Dynamic models, on the other hand, combine the idea of loops and stages to depict the way innovation is changed and affected by various factors. However, dynamic models which are based on the life cycle stages only consider the factors influencing innovation at a certain point in time, for example at the early or growth stages of organisation development, and the influencing factors which are favourable for innovation at a particular stage, may not be favourable at another stage of organisation development (Miller and Friesen, 1984), thereby suggesting that the organisation's past may have an effect on present activities.

As argued by Bryson (2008), using the residual, dominant and emergent (RDE) theoretical framework developed by Williams (1980), at a certain time, both static and dynamic factors coexist and affect organisational operations. However, the existing KM related innovation models only consider either static or dynamic aspects of innovation due to the limitations of the methodologies or theories they have employed (Wolfe, 1994). More precisely, these models have ignored the effect of past and emerging KM practices on innovation as the key focus is on the dominant KM practices. Bryson (2008:749), following Williams' framework, defines the dominant, residual and emergent organisation as follows:

*"Dominant represents the practices and beliefs which are organised and lived, that organisation members put energy into"*

*"Emergent represents the new practices and beliefs which are continually being created, that may or may not be incorporated"*

*"Residual represents the still practised or believed residue of earlier life in the organisation that assists in making sense of the present".*

In this study, we argue that limitations of life cycle theories can be overcome by applying the RDE framework as it helps to recognise the knowledge management dynamics over time whilst providing the opportunity to analyse the interactive nature of past, present and future (Bryson, 2008). Based on the research gap and the primary aim of this study, the main research question addressed was established as "How do the dynamics of knowledge management influence firms' innovation activities and the pattern of innovation adoption over time". The effects of knowledge management

dynamics on innovation activities and pattern of innovation adoption are demonstrated through the discussion of four case studies conducted in Sri Lankan software firms, a developing country context.

**Research Method**

The aim was to understand how the knowledge management dynamics affect the adoption of innovation over time. The design research thus necessitated the understanding of phenomena within its natural settings. Hence, the case study strategy was the best option as it helped the researcher to collect the natural characteristics of the situation, and thus, to capture the richness of the context. Yin (2003:13) states that a case study is "an empirical inquiry that investigates a contemporary phenomenon". The study used four software companies, and data came from in-depth interviews and company documentations. In selecting four cases, the organisation's capacity to develop and implement innovation served as the basis. Company A was founded in 1996 as a software development company in one of the back rooms of the founders' residence in Colombo, Sri Lanka. The founders included: husband and wife, two of their foreign friends, and family members, and their aim in establishing the company was the innovation of their software products using an international team. They attempted to build, create, innovate, and bring software applications to market faster than competing firms. The aspiration of the founders eventually created a leading IT company with a client base serving Global 2000 companies. The company provides a wide range of IT disciplines including outsourcing, mobile application developments, software testing and assets management, and developing software products for leading enterprise software providers. It has a staff of 1,200 in the Sri Lankan Development Centre and over 5,000 staff globally. Case Study B is a public company founded in 1983. Service and asset management, manufacturing, supply chain, and projects are the core business areas of Company B which operates in 60 countries with 2,700 employees in total. Its Sri Lankan centre, the second largest foreign software firm operating in Sri Lanka, was formed in 1997. After continuous growth, the Company now employs over 700 employees and has won prestigious awards including the Customer Value Enhancement Award for its innovations. Company C is a Sri Lankan software development company established in 1997 with the aim of supplying high quality software solutions. It now operates in the United States, Singapore, India, and Malaysia, with a staff of 130. The company has won several awards including the prestigious Red Herring Global Award for its innovations. Currently it caters for the telecom and financial markets. The company is well-recognised for its mobile solution innovation and HR application innovation. Company D is a technology leader in the provision of e-security and e-payment solutions to corporate organisations in Sri Lanka. It has a staff of 45 and was founded in 1998. It is committed to innovating and implementing world-class IT solutions. The company's core business includes secure electronic payments, information systems security, and mobile enterprise automation, and it also secures document personalisation. Company D is recognised as a technology leader in the banking and information security domains and it has won the highest number of awards for innovation including the National Best Quality Software Award. In addition, it has won the Asia Pacific ICT Award for innovative mobile banking solutions. In total, 44 interviews were conducted including top managers, middle managers and frontline employees. All interviews were semi structured and the focus of interviews was on obtaining deep insight into knowledge dynamics and innovation within four companies. Before the field work starts, the semi structured interview protocol was

developed and tested. Once agreement to access to the forms was received, the semi structured interview protocol was sent to the respondents. The contacts at the case companies helped to identify the key respondents at different levels within the firms. In addition, the researcher was given the opportunity to interview randomly- selected employees. The interview protocol was designed to include an initial open question to establish the participant's background and relax the interviewee. Each person was invited to talk about the present situation first and then discuss the knowledge management dynamics and their effect on innovation. A series of potential prompts was used when necessary, to gain information to help explore their experiences. All interviews were face-to-face and they ranged between one and a half hours and two hours in length. As retrospective interviews rely on the accurate recall of past events by individuals, several disadvantages such as incomplete or inaccurate retrieval may arise. In addition, selective or biased recall by the interviewees may occur. This was recognised in advance and triangulation of data helped to check the accuracy of information provided by respondents. The interview process was conducted and assessed on collective background, and company archives, annual reports, and organisation charts were also used to corroborate the interview and questionnaire data. When a theme emerged from one participant, corroboration of the same theme was sought from others involved in interviews. Many interviewees had worked in the firms from its inception hence respondents have experienced key dynamics of the organisation. In addition to conducting interviews, documentation and reports were triangulated with verbal responses to increase data validity and reliability. The study used pattern matching and explanation building for case study data analysis. This is because the aim of this study was to identify the effect of knowledge management dynamics on pattern of innovation adoption over organisation life cycle, which required the comparison of empirical based patterns with the patterns predicted. The explanation building technique supported the researcher to build explanation on how the knowledge management dynamics affect the adoption of innovation over time.

## Findings

### *Acquisition of Product-Specific Knowledge through informal methods, Self-Learning and relying on Tacit Knowledge as Residuals*

Analysis of the case data suggests that self-learning became the key approach used by individuals to learn new things at the early stages of the firm's existence. This is because the lack of resources precluded other facilities enabling them to learn. It was also evident that previous learning experiences remained active within the minds of employees with long tenure in the present organisation life as residuals which acted as criteria to make judgments and evaluations of the current behaviour and working practices of new employees.

> We learned every thing by ourselves. It is hard but it is the best way that somebody can learn. It helps you to think differently and see the big picture. Now the company runs well-developed training programmes. Everyone can access the company intranet and database. But people don't exploit opportunities. Especially, young people do not show enthusiasm to learn new things and it prevents them from exploring innovation.
>
> (Senior project manager Company C)

Utterback and Abernathy (1975) state that product innovations are driven or stimulated by new market needs and opportunities at the early stages of firm development. This was featured within all the four companies when the business

domain-specific knowledge had been the main knowledge concern of the early phase of organisational life since the absence of this appeared as a major barrier to innovation. The evidence suggested that such knowledge was acquired gradually over time by these companies.

> In the initial years, it was of course domain knowledge that we needed to know. In those days, there were lots of implementation issues because we had very little idea about clients' business. We did not have advanced technologies and that was also an issue. But the main issue was the lack of domain knowledge and we improved this knowledge by working with clients and conducting research. Now our priority is different and we spend a considerable amount of money for training and purchasing new technologies as software innovations require new technologies.
>
> (Senior executive from Company A)

Knowledge sharing (KS) appeared not to be a concern of the residual culture as it happened in informal ways due to the strong social bonds among employees, and was not required any formal intervention by the top management. This occurred because in the beginning, employees were working in small teams and had the chance to share their views freely and often. This confirmed that small teams were more effective for KS which consequently enhanced the effectiveness of innovation activities.

> In those days, there was no particular ways or place. In the canteen, office, bus, or sometimes even when we were at home, we used to discuss issues related to the company and developments. It helped us to discuss issues more deeply. Now things are formal and all information are stored in the company database. So I do not see the same level of interactions among people.
>
> (Project manager Company D)

The over-reliance on information technology was perceived as unfavourable for effective KS in the long run as it limited the face-to-face interaction among members. At the early stages, the firms overly relied on tacit knowledge of individuals but when the firms grew, this emphasis was shifted to explicit knowledge as the firms developed fully integrated database to facilitate software development activities. The conflict between residual and dominant KM practices was evident through the displeasure expressed over dominant practices that limited KS through social interaction.

> Before, it was more effective because if someone had a problem, others demonstrated how to do it. Now everything is in the system and people need more time to learn. I do not think colleagues read all these blog posts and white papers. The system we had before was really effective. The new system is faster but it is less effective. It may be time-consuming but management should provide more opportunities to discuss issues with others since it provides the opportunity to learn things more deeply.
>
> (Software engineer Company A)

Wiig (2004) argues that people interaction is the key requirement for KS, and this was an argument supported by the interviewees who saw face-to-face interaction as more effective, allowing instant feedback and the opportunity to experience the tacit knowledge that assisted in the implementation of innovation. People within the company preferred old practices as they set up a ground for more social interaction.

Hence, the lack of interactive systems was seen to affect employee motivation negatively and cause impediments to innovation activities.

***Acquisition of Knowledge through Formal methods, Explicit Knowledge and Focusing on Technology-specific Knowledge as Dominant***

The cross case analysis confirmed that at the growth stage, the focus was on obtaining and applying advanced technology as these firms attempted to differentiate their products from those of their competitors. The analysis of data showed that technology-specific knowledge was essential for process improvements, and domain-specific knowledge was necessary for product development.

> Our company now spends heavily in developing technical knowledge and skills because we want to improve the quality of our products.
>
> (Software engineer Company B)

These firms hold the view that the principal competitive factors contributing to the firm's business success include technical expertise and industry knowledge, a breadth of service offerings to provide one-stop solutions to clients, responsiveness to clients' business needs, and quality of services. All top level managers and employees believed that improving organisational efficiencies and reducing cost were the key factors that contributed to the success of the company. The dominant belief was that these aims could only be achieved through improving the technology-specific knowledge and skills of employees. As a result, when these four firms reached the growth stage, the acquisition of advanced technologies has become a key priority.

> We invest in deepening our technology-specific knowledge to meet the specific needs of clients in our present markets. We are satisfied with our domain knowledge but technology is something that we always need to keep an eye on. Our developments are very innovative but we are not good in areas like reducing cost and shortening the delivery cycle. That is why we invest in technologies and improving skills of people.
>
> (Senior software engineer from company C)

The case analysis showed that self-learning had a significant influence on the innovation process of these firms. They stressed the importance of continuous learning for enhancing process innovation and saw this as a key priority of their dominant working environment. With their growth, the firms have learned the importance of proper KM systems and thus, KM has become a key management priority and they have adopted more formal KM systems while stimulating KS across all borders of the organisation.

> In those days, there was no particular ways or place. In the canteen, office, bus, or sometimes even when we were at home, we used to discuss issues related to the company and developments. It helped us to discuss issues more deeply. Now things are formal and all information is stored in the company database. So I do not see the same level of interactions among people but self-improvement and constant learning are key aspects of the company culture. We are now putting more efforts to learn new methods to improve process aspects like functional testing and platform validation.
>
> (Project manager from company A)

The case data further detailed the methods used to share knowledge as including blog post, team discussions, and internal publications, all of which were found to have a positive effect on innovation as employee accessed the required knowledge with ease. Koh and Kim (2004) also found that online databases, virtual communities, and

intranets were used by many firms for KS. However, respondents went on to rank discussions as the most effective way to share knowledge due to their interactive nature that allowed employees to obtain on-the-spot solutions with little effort.

> We have very advanced systems for knowledge sharing. We always use our blog post, team discussions, and internal publications for this purpose. Those methods are useful but I would like to rate face-to-face discussions top of the other methods because they provide more deep knowledge with little effort.
>
> (Associate Engineer of company B)

Encouraging employees to contribute knowledge was seen as necessary to support innovation, and was done by providing incentives for engagement in KS. However, it emerged that members were information overloaded and reluctant to read most of the information shared by the company, and this represented a barrier to innovation, and simultaneously highlighted the importance of proper systems for knowledge filtering to support innovation activities.

> The good thing is … We are paid if we publish a white paper but we do not have time to read things because there are so many white papers and information on screen.
>
> (Software Engineer of company C)

As discussed by Argyris and Schon (1978), many organisations fail to maintain a balance between existing knowledge preservation activities and new knowledge creation activities due to less effective learning systems. The analysis of case data suggested that effective management of information was an essential condition for innovation as such practice supports innovation by allowing members to access the most important information with minimum effort. Information overloading was featured as unfavourable to innovation although the leadership and management support for KS-specific activities created a KS-friendly working environment.

***Obtaining Knowledge for Improving Organisational Efficiency and Effectiveness by Networking with wider community as Emergent***

Taking action to improve the contribution to knowledge by each member was highlighted and featured as an emergent aspect and this was recognised as an enabler of innovation within all four case companies.

> Storing knowledge in the company database is not enough. All employees should use it and need to contribute to it. But it does not happen as we want and we hope to improve this aspect in future.
>
> (Associate manager from company B)

In the next phase of development, it is seen that the KM system is gradually becoming more autonomous and formal. All four companies highlighted the importance new strategies to acquire new knowledge in order to improve the efficiency of organisation operations. Particularly, these firms expect to learn new managerial approaches and external knowledge at the later stages since they focus on expanding business and making productivity improvements.

> We have to look for ways to reduce cost and improve operational efficiency and learn more about new strategies to achieve these aims in the future.
>
> (Senior consultant from company A)

Consequently, the focus is being shifted to obtain external knowledge.

> We need more research to improve the operational efficiency and the standard of company e-solutions. We are looking for the opportunity to do some joint research with universities.
>
> (Senior manager company D)

The cross case analysis shows that these firms value interaction between customers and operational level employees, and aims to increase this by having employees liaise with customers directly before and after the deployment of software solutions as this provides the opportunity to learn about the client's business as well as handling technical issues directly, and developing strong relationships.

> If there is any technical issue, developers are the best people to address it. Now, it is done by the product managers. If developers can directly deal with clients they have more opportunities to learn about the client's business process so we are going to allow our engineers to directly communicate with clients before and after project implementation.
>
> (Project manager company C)

The analysis of case study data also stress the importance of sharing knowledge with wider communities and it was featured that the emergent culture supports more engagement with external communities for knowledge enhancement activities. These practices indicate the importance of systematic ways to capture and share knowledge as such an approach assists idea generation and the successful implementation of innovation.

> We will give more priority to develop strong links with all stakeholders and it will not only be limited to clients because we have realised that external communities can contribute to company learning activities greatly.
>
> (Senior manager company C)

Scott and Bruce (1987) stated that in the later stages, firms struggle to manage growth and control their operations, and that most of them face administrative, business expansion, and market-related problems. In these circumstances, firms actively seek new managerial approaches and external knowledge as they focus on expanding business and productivity improvements, which in turn support the adoption of organisational innovation.

> Mainly we will focus on finding the best way of improving the operational issues and people- related issues, especially the retention of employees, and also obtaining knowledge of new markets where we expect to operate.
>
> (Director from company B)

The cross case analysis also suggests that with the firm's growth, more attention has been devoted to improving the productivity of the KM system, and that top management plans to introduce a highly automated KM system, as confirmed by Respondents.

> Plans are already set up to improve the current KM system because we want to reduce the time and effort that people need to access, filter and analyse data.
>
> (Business analysts company D)

Obtaining knowledge to increase operational efficiency and competitiveness were highlighted in all four companies. Moreover, the data shows that all these firms are planning to extend their social networks by linking with external communities, which was identified as an enabler of innovation.

> We expect to extend our knowledge-sharing practices beyond the company by linking with students, professionals, academics and all other shareholders.
>
> (Senior manager company C)

It was suggested that the emergent culture of the firm reinforces the business expansion requirements as the firm expects to obtain competitive advantages by operating in new markets. This emphasis in turn influences the emerging knowledge concerns of the company, and its innovation adoption decisions. It was identified that obtaining knowledge of new markets and marketing strategies is becoming a key priority of the emerging culture. The findings revealed that the four firms actively seek new managerial approaches and external knowledge at the later stages as they focus on expanding businesses and making productivity improvements.

**Discussion**

The study provides a complete overview of knowledge management dynamics and evolution of innovation within the four software firms. The application of RDE framework in this study has facilitated to uncover the complex nature of innovation and the evolution of KM practices over time (see Table 1) rather than limiting to recording of current KM practices. The study revealed the interdependent nature of past, present and emerging innovations and KM practices. For instance, a desire to preserve the residual KM practices was a strong theme identified in the study which shows the static elements of KM and innovation within these four firms.

Table 1. KM Dynamics and Pattern of Innovation Adoption

| Stages | Innovation Focus | KM Focus | Acquisition | Storing | Sharing | KM Issues | RDE |
|---|---|---|---|---|---|---|---|
| **Start up** | Product | Learning to innovate products | Self – learning dominant Knowledge acquired through motivated individuals and informal sources | No formal methods or efforts to store knowledge<br><br>Individual with tacit knowledge contributing to innovation | Informal discussions | Lack of business domain specific knowledge<br><br>Lack of individuals with tacit knowledge | **Residual** |
| **Growth** | Process | Learning to innovate process | Through central database<br><br>Dedicated teams and experts in the company | Develop integrated database<br><br>Making knowledge explicit | Use intranet<br><br>Publishing white papers<br><br>Dedicated team and experts sharing knowledge | Lack of motivation to share knowledge<br><br>Lack of social interactions<br><br>Information overloading | **Dominant** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Mature** | Organisational | Learning to exploit product and process innovations and organisational efficiency | Through extended internal and external sources | Developing highly autonomous and extended KM system<br><br>Clients and partners contributing company knowledge | Communities of practice and mobile apps<br><br>External networking | Increasing the efficiency and effectiveness of KM system | **Emergent** |
| **KM Activities** | | | | | | | |

As discussed by Utterback and Abernathy (1975), in the early stages, obtaining product-specific knowledge becomes a key strategic priority of firms which supports them to introduce product innovation in order to establish in the selected market segment. However, at the start-up phase, lack of tacit knowledge become a barrier for introducing innovation. The findings showed that obtaining product-specific knowledge becomes residual when the firms grow. The reason why the firm seeks such knowledge is associated with the level of employee competencies since at the early stages of firm development, there was a lack of business domain-specific knowledge. The residual working environments of these firms value self-learning which is considered as the most effective since it has helped them to develop more innovative applications in the early stages when there was no formal training provided by the firm due to lack of resources, mainly financial, and the absence of competent trainers. Self-learning thus became more effective since it was a more internally-driven process, which provided the opportunity for action and reflection. Further, the study findings revealed that it was more effective in an environments where there were strong relationships among employees. Being based on action and reflection, it had provided the opportunity for experimentation, which was recognised as more favourable for idea generation and implementation. In fact, the effect of residuals was evident in employees' reflection on their previous KS practices, particularly when they attempt to preserve their previous KM practices. The case data indicates that regardless of power or assigned duties, members supported each other's work, showing that job performance and innovative outcomes were determined by relationships, not authority. Work was generally assigned to individuals but people worked as a team with no formal managerial intervention which support more interactive KS process. Wiig (2004) argues that people interaction is essential for effective KS, and such interaction was featured in the early life cycle phases of all four companies. The development of internal competencies, which later helped them to stimulate the learning process, was directly aimed at producing process innovation as staff actively learned and applied technology for the improvement of process elements. It was shown that with growth, the firms have identified the importance of well-integrated databases and KM systems and thus, KM became a key management priority. The study revealed that the organisations have adopted a learning mode by developing more formal KM systems whilst stimulating KS across all borders. Emphases on technology-specific knowledge as discussed by Abernathy and Utterback(1978), managing a central knowledge base, and formal KS practices were seen as dominant features of the KM systems within the four firms, and these systems were found to increase the amount of KS and innovation initiatives. However, the lack of social interaction was perceived as a barrier to KS, and hence to innovation. When

the firms grow, they were actively seeking new managerial approaches and external knowledge as the top leadership concentrated on expanding their business, plant upgrading, and productivity improvements. The findings suggested that the emergent organisations focused on reconfiguring their internal systems, and refined their structures to enhance the efficiency of their activities wherein more attention was given to organisational innovations rather than other three types i.e. product, process and marketing innovations. It was further evident that when they grow, linking with external institutions and communities to advance their knowledge become emerging trend. Emerging organisations supported more autonomous KM systems and explored knowledge which helped them to solve efficiency-related issue. Such a strategy can be seen as favourable for innovation since the networking with external parties often allow them to expose to unexpected knowledge as discussed by Dyer and Singh (1998). The study revealed that in the later stages, firms struggle to manage growth and control their operations, and that most of them face administrative, business expansion, and market-related problems. In these circumstances, firms actively seek new managerial approaches and external knowledge as they focus on expanding business and productivity improvements.

**Conclusion**

This study shows how the knowledge management practices of technology based small firms evolve over time and affect the adoption of innovation to achieve business objectives. As concerns the first contribution, the study established that the residual and emergent KM practices play a vital role in innovation adoption in addition to the dominant knowledge management practices. The desire to preserve the informal KM practices was seen as a strong theme and this was found to have a negative effect on employee motivation and commitment. Learning product skills becomes the main knowledge concerns of software firms at the very early phase of organisational development when informal KM practices prevailed within these firms. At the start-up phase, lack of tacit knowledge appeared as a barrier to innovation. The study revealed that there is a constant struggle of dominant, residual and emergent KM practices. This finding is important as it emphasise the importance of analysing dominant KM practices as well as emergent and residual KM practices to support innovation.

As for the second contribution, we found that the KM practices changes from more informal to more formal KM practices over time, which have an impact on innovation focus. This study found that at the start up phase, firms focus on domain specific knowledge which has a favourable effect on product innovations. At the very early stages, individuals play a vital role in implementing innovation and innovation is significantly influenced by the tacit knowledge rather than the explicit knowledge. The lack of knowledge expertise limits experimenting advance projects and process innovation at the start-up phase. On the contrary, when software firms grow, they continuously invest to adopt different type of process innovations, thus obtaining technology specific knowledge become a key priority. At the later stages, explicit knowledge is gradually developed and has a favourable effect on innovation activities. The study also revealed that the span of control becomes an issue over time, and as a result obtaining new knowledge related to new organisational methods, business practices, and external relationships emerge as a strategic priority which have a favourable effect on organisational innovation as firms attempt to increase operational efficiencies and exploit existing capabilities by reconfiguring the organisational structure and administrative systems.

This study is based on the case study strategy. The limitation of the case study method of research is its representativeness and generalisability. Although caution was exercised, replication and generalisation of the findings to a wider population may be difficult. However, this study laid an important foundation for future research on the subject of how to achieve high innovation capabilities by developing a well -designed KM systems. It therefore expands the existing knowledge about the subject matter. One of the ways in which the generalisability of this research can be developed is through a large scale survey within different industries.

From a practical implementation perspective, this research empowers organisations to achieve a high level of innovation capability by managing knowledge capabilities and emphasising the importance of an innovation audit based on the organisation's past, present and future KM practices, to identify the effects of KM dynamics on innovation. Using the outcomes of this research, organisations can place themselves in a position where they can achieving a high level of innovation since they are able to appreciate the varying effects of KM practices on innovation at different stages of firm development.

**References:**


Abernathy W.J , Utterback J.M., 1978. Pattern of industrial innovations. Technology Review, 80(7) 40 -47.

Afuah, A., 2003. Innovation Management. New York: Open University Press.

Ahuja, G., Katila, R., 2004. Where do resources come from? The role of idiosyncratic situations. Strategic Management Journal, 25(8-9): 887-907.

Allen, R,C., 1983.Collective invention. Journal of Economic Behavior and Organization, 4(1), 1-24.

Alavi, M., Leidner, D. E., 2001. Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. MIS Quarterly, 25(1),107-136.

Alajoutsijarvi, K., Mannermaa, K , Tikkanen. H .,2000. Customer relationship and the small software firm: A framework for understanding challenges faced in marketing. Information & Management, 37, (3),153–159.

Argyris, C.,Schon, D.A.,1978. Organizational Learning: A Theory of Action Perspective.Reading, MA: Addison-Wesley.

Argyris, C.,1993.On Organizational Learning. Cambridge, MA: Blackwell.

Audretsch, D, B., Feldman, M, P .,1996. Innovative Clusters and the Industry Life Cycle. The Review of Industrial Organization ,11(2), 253–273.

Barras, R.,1990. Interactive innovation in financial and business services: the vanguard of the service revolution. Research Policy, 19, 215–37.

Bercovitz., J.E.L, Feldman., M.P.,2007. Fishing upstream: Firm innovation strategy and university research alliances. Research Policy, 36, 930–948.

Breslin, D., Jones, C.,2012. The evolution of entrepreneurial learning. International Journal of Organizational Analysis, 20(3 ), 294 -308.

Bryson, J, 2008. Dominant, emergent, and residual culture: the dynamics of organizational change. Journal of Organizational Change Management, 21 (6).743 – 757.

Calantone, R.J., Cavusgil, S.T., Zhao, Y. ,2002.Learning orientation, firm innovation capability, and firm performance. Industrial Marketing Management, 31, 515–524.

Carneiro, A.,2000. How does knowledge management influence innovation and competitiveness?. Journal of Knowledge Management, 4 (2 ), 87 – 98.

Chiaroni, D., Chiesa, V., Frattini, F.,2010. Unravelling the process from Closed to Open Innovation: evidence from mature, asset-intensive industries. R& D Management, 40,(3), 222-245.

Charterina, J, Landeta, J.,2013.Effects of Knowledge-Sharing Routines and Dyad-Based Investments on Company Innovation and Performance: An Empirical Study of Spanish Manufacturing Companies. International Journal of Management, 30 (2), 197-216.

Chen, C., Huang, J.,2009. Strategic Human Resource Practices and Innovation Performance –The Mediating Role of Knowledge Management Capacity. Journal of Business Research, 62, 104–114.

Cohen, W, M. Levinthal, D, A.,1990. Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly 35(1)128-152.

Cohen, W M., Klepper, S.,1992.The Tradeoff between Firm Size and Diversity in the Pursuit of Technological Progress. Small Business Economics, 4(1), 1-14.

Connelly, C.E., Kelloway, E.K.,2003.Predictors of employees' perceptions of knowledge sharing culture. Leadership and Organization Development Journal, 24 (5), 294-301.

Coopey, J.,1995. The Learning Organization: Power Politics and Ideology. Management Learning 26(2): 193-214.

Coopey, J.,Burgoyne, J.,2000.Politics and Organizational Learning. Journal of Management Studies, 37(6), 869-885.

Dalkir, K.,2005. Knowledge Management in Theory and Practice. Oxford: Elsevier Butterworth-Heinemann.

Damanpour F., Gopalkrishnan. S.,2001. The dynamics of the adoption of product and process innovations in organizations. Journal of Management Studies. 38:1 , pp 45-65

Davenport, T.H., 2007.Information technologies for knowledge management. In K. Ichijo and I.Nonaka (Eds), Knowledge Creation and Management: New Challenges for Managers, (pp97-117),New York, NY: Oxford University Press.

Denning, S.,2013.Why Agile can be a game changer for managing continuous innovation in many industries. Strategy and Leadership, 41 (2 ), 5-11.

Desouza, K., Awazu, Y.,2003. Knowledge Management. HR Magazine, 03, 107-112.

Dyer, J.H., Singh, H.,1998.The relational view: Cooperative strategy and sources of interorganizational competitive advantage. Academy of Management Review, 23, 660–679.

Elliott, R., Friston K.J, Dolan, R. J.,2000.Dissociable neural responses in human reward systems. The Journal of Neuroscience, 20,(16),6159–6165.

Floricel , S , Dougherty, D.,2007.Where do games of innovation come from? Explaining the persistence of dynamic innovation patterns. *International Journal of Innovation Management*, *11*(1), 65–91.

Galliers, R.D, Newell, S.,2000. Back to the Future: From Knowledge Management to Data Management. Information Systems Department: Working Paper No.92, London School of Economics: London, UK.

Garriga, H., Von Krogh, G., Spaeth, S.,2013. How constraints and knowledge mediate open Innovation. Strategic Management Journal, 34(9)1134-1144.

Gibb, A.,1997. Small firms' training and competitiveness: building upon small business as a learning organisation. International Small Business Journal, 15(3), 13-29.

Grant, R.M., 1996.Prospering in Dynamically— Competitive Environments: Organizational Capability as Knowledge Integration. Organizational Science, 20, 375-387.

Grant, R.M.,1996.Toward a Knowledge-based Theory of the Firm. Strategic Management Journal, 17, 109-122.

Hall, R. , Andriani, P.,2002.Managing knowledge for innovation. Long range planning., 35 (1). 29-48.

Hadjimanolis, A. 1999. Barriers to innovation for SMEs in a small less developed country (Cyprus). *Technovation*, 19: 561–570.

Harhoff, D., Henkel, J., von Hippel, E.,2003. Profiting from voluntary information spillovers:how users benefit by freely revealing their innovations, Research Policy, 32( 10),1753–176.

Heavin, C, 2012. Dealing With Uncertainty through KM: Cases in Four Software SMEs, Proceedings of the European Conference on Information Management and Evaluation, 117-126.

Heo, K.,2008. HRD's strategic role in developing a high performance organization. Journal of Korean Human Resource Management, 15(1), 219–229.

Hodgkinson, G. P, Wright, G.,2002.Confronting strategic inertia in a top management team:Learning from failure. Organization Studies, 23(6), 949–977.

Hogel, M., Parboteeah, K.P., Munson, C.L.,2003.Team-level antecedents of individuals'knowledge networks. Decision Sciences, 34 (4), 741-70.

Howells, J.,1996.Tacit knowledge, innovation and technology transfer. Technology Analysis and Strategic Management, 8, 91– 106.

Janz, B.D., Prasarnphanich, P.,2003.Understanding the antecedents of effective knowledge management: The importance of a knowledge-centered culture. Decision Sciences, 34(2), 351-384.

Jiang, X., Li, Y.,2009. An empirical investigation of knowledge management and innovative performance: The case of alliances. Research Policy, 38 .358–368.

Jordan, G., Segelod., E, 2006. Software innovativeness: Outcomes on project performance, knowledge enhancement and external linkages. R&D Management, 36( 2): 127–142.

Kirby, J., Knapper, C., Evans, C., Carty, A, Gadula, C., 2003.Approaches to learning at work and workplace climate. International Journal of Training and Development, 7(1), 31 – 52.

Kline, S., Rosenberger, N., 1986. An Overview of Innovations. In , R. Landau and N. Rosenberger (eds), The Positive Sum Strategy. Harnessing Technology for Economic Growth(pp 207-306). Washington, D. C, National Academic Press.

Koh, J., Kim, Y.G.,2004.Knowledge sharing in virtual communities: an e-business Perspective. Expert Systems with Applications, 26 (2), 155-66.

Kotha, R., Zheng, Y., George, G.,2011. Entry into new niches: the effects of firm age and the expansion of technological capabilities on innovative output and impact. Strategic Management Journal, 32, 1011–1024.

Koplyay, T., Chillingworth, L., Mitchell, B., 2013.Corporate Lifecycles: Modelling the Dynamics of Innovation and Its Support Infrastructure. Technology Innovation Management Review, 2. 22–29.

Lam, A., 2000. Tacit knowledge, organisational learning and societal institutions: an integrated framework. Organisational Studies, 21(3), 487–511.

Lam, A.,1997. Embedded firms, embedded knowledge: problems of collaboration and knowledge transfer in global cooperative ventures. Organization Studies, 18(6), 973–996.

Leonard-Barton, D.,1992. Core capabilities and core rigidities: A paradox in managing new product development. Strategic Management Journal, 13(1), 111–125.

Leonard, D.,2003. Don't lose your best asset. Computer Weekly. Retrieved from http://www.computerweekly.com/opinion/Thought-for-the-day-Dont-lose-your-best-asset.

Lin, H.F., Lee, G.G.,2006. Effects of socio-technical factors on organizational intention to encourage knowledge sharing. Management Decision, 44 (1), 74-88.

Lundvall, B.,1988. Innovation as an interactive process - from user-producer Interaction to National Systems of Innovation. In C. Dosi, , R. Nelson, , G. Silberberg and , G. Soete (Eds. ), Technical Change and Economic Theory. London, Printer Publishers.

Lundvall, B, Johnson, B .,1994. The learning economy. Journal of Industry Studies. 1(2), 23-42.

March, J.,1991. Exploration and exploitation in organizational learning. Organization Science 2 (1), 71–87.

Miller, D., Friesen, P.H.,1984. A longitudinal study of the corporate life cycle. *Management Science ,30*,1161-1183.

Morrison, A. , C. Pietrobelli, and R. Rabellotti (2008). "Global Value Chains and Technological Capabilities: A Framework to Study Learning and Innovation in Developing Countries", *Oxford Development Studies*, 36(1), 39-58.

Moran, P., & Ghoshal, S.,1996.Value creation by firms. In J.B. Keys and L.N. Dosler (Eds).Academy of Management, Best Paper Proceedings, Statesbora, GA: Southern University.

Morrow, J. L., Sirmon, D. G., Hitt, M. A., Holcomb, T. R., 2007.Creating value in the face of declining performance: Firm strategies and organizational recovery. Strategic Management Journal, 28, 271-283.

Nahapiet, J., S., Ghoshal. S.,1998.Social Capital, Intellectual Capital and the Organisational Advantage. Academy of Management Review, 22,(2), 242-266.

Newell, S., Swan, J., 2000.Trust and inter-organizational networking. Human Relations, 53(10), 1287-1328.

Nonaka, I, Takeuchi, H.,1995.The Knowledge-Creating Company, New York. Oxford University Press.

Nonaka, I., Schamer, O., Toyama, R., 2001.Building Ba to enhance knowledge creation: an innovation at large firm. Retrieved from www.dialogonleadership.org/Nonaka_et_al.html.

OECD.,2005, The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data: Oslo Manual, 3rd ed., OECD, Paris.

Polanyi, M.,1962. Personal Knowledge: Towards a Post Critical Philosophy. London Routledge.

Polanyi, M.,1966. The Tacit Dimension. London, Routledge and Kegan Paul.

Probst, G. J. B., Buchel, B. S. T.,1997. Organizational learning: The competitive advantage of the future. London: Prentice Hall

Quinn, J.B., Cameron, K., 1983.Organizational life cycles and shifting criteria of effectiveness: Some preliminary evidence. Management Science, 29, 33-51.

Revans, R.,1998. ABC of Action Learning. London: Lemos and Crane. Review, 45 (6), 102-112.

Rosenkopf, L, Nerkar, A.,2001 Beyond Local Search: Boundary-Spanning, Exploration, and Impact in the Optical Disk Industry. Strategic Management Journal, 22( 4 ),287-306.

Saleh, S.D., Wang, C.K.,1993.The management of innovation: strategy, structure and organizational climate. IEEE Transactions on Engineering Management, 40 (1), 497-510.

Savage, C, M.,1990. 5th Generation Management. Digital Press. Science Quarterly,25,72- 88.

Schumpeter, J.A.,1934. The Theory of Economic Development. Cambridge, MA: Harvard University Press.

Schroeder, R. G., Van de Ven, A., Scudder, G. D., Polley, D.,1989. The development of innovation ideas. In A. Van de Ven, H. L. Angle, and M. Poole (Eds.), Research on the management of innovation, The Minnesota studies. New York: Harper & Row.

Scott, M, Bruce, R.,1987.Five stages of growth in small business. Long Range Planning, 20( 3), 45-52.

Smith,M, Busi M, Ball, P, Van Der Meer, R.,2008.Factors influencing an organisation's ability to manage innovation: A structured literature review and conceptual model. International Journal of Innovation Management 12(4) 655-676.

Skerlavaj, M., Song, J.H., Lee, Y.,2010.Organizational learning culture, innovative culture and innovations in South Korean firms. Expert Systems with Applications, 37, 6390–6403.

Song, S.,2002.An internet knowledge sharing system, Journal of Computer Information Systems, 42(3), 25-30.

Storey, J., Quintas, P., 2001,.Knowledge management and HRM. In J. Storey (Ed.). HRM – A Critical Text, UK: Thomson Learning.

Tidd, J., Bessant, J.,2011. Managing Innovation: Integrating Technological, Market and Organizational Change. Chichester: John Wiley & Sons.

Tsai,W., 2000.Social Capital, Strategic Relatedness and the Formation of Intraorganisational Linkages. Strategic Management Journal, 21, 925 -939.

Utterback, J.M.,1994. Mastering the Dynamics of Innovation: How Companies can seize Opportunities in the Face of Technological Change. Boston, MA: Harvard School Press.

Utterback, J. M., Abernathy, W. J., 1975. A dynamic model of process and product innovation. Omega, 3(6), 639–656.

Van de Ven, A. H., 1986. Central Problems in the Management of Innovation. Management Science, 32(5), 590-607.

Varis, M., Littunen, H., 2010.Types of innovation, sources of information and performance in entrepreneurial SMEs. European Journal of Innovation Management, 13(2). 128-154.

West, M. A. Farr, J. L.,1990. Innovation and Creativity at Work: Psychological and Organizational Strategies. Oxford: John Wiley & Sons.

West III. G.P., Noel. T.W., 2009). The Impact of Knowledge Resources on New Venture Performance. Journal of Small Business Management, 47, (1), 1–22.

Wiig, K., 2004.People-Focused Knowledge Management, Oxford: Elsevier.

Williams, R.,1980. Problems in Materialism and Culture. London :Verso.

Wolfe, R.,1994. Organisational Innovation: Review, Critique and Suggested Research Directions. Journal of Management Studies, 405-431.

Wong, M .S. Stephen, J., George, P., 2010.Cultural issues in developing E-Government in Malaysia. Behaviour & Information Technology, 29, (4), 423–432.

Yin R. K., 2003. Applications of case study research. London, Thousand Oaks: Sage .

Van de Ven, A. H.,1986. Central Problems in the Management of Innovation. Management Science, 32(5), 590-607.

von Hippel, E.,1989.Sources of Innovation. London: Oxford.

Washo, M., Faraj, S.,2000.It's What One Does: Why People Participate and Help Other in Electronic Communities of Practice. Journal of Strategic Information Systems, 9, 155-173.

Wiig, K.,2004.People-Focused Knowledge Management, Oxford: Elsevier.

Zack, M. H.,1999. Developing a Knowledge Strategy. California Management Review,41(3),125-145.

Zahra, S. A., Filatotchev, I., Wright, M.,2009. How do threshold firms sustain corporate entrepreneurship? The role of boards and absorptive capacity. Journal of Business Venturing, 24, 248-260.

Zahay, D Griffin, A., Fredericks, E., 2011. Information Use in New Product Development: An Initial Exploratory Empirical Investigation in the Chemical Industry, Journal of product innovation management, 28, 485–502.

Zaltman, J., Duncan, R., Holbek, J.,1973. Innovation and Organizations. New York: John Wiley & Sons.

Zhu, Y., Wittmann, X. and Peng, M.W. (2012). Institution-based barriers to innovation in SMEs in China, Asia Pacific Journal Management, 29, 1131-1142.