Knowledge Management and Business Process Reengineering for Business Performance Improvement

Madalina **Constantinescu**
Faculty of Financial Management Accounting,
Spiru Haret University, **ROMÂNIA**
constantinescu_madalina2002@yahoo.co.uk

Abstract

Organisations have always realised that access to quality information and knowledge will help them remain competitive. However, with the advent of rapidly changing business environments, managers are now realising they need to develop an effective knowledge strategy and provide employees with best available knowledge to support the decision making process. The paper addresses this within the context of how Decision Support Systems, Artificial Intelligence and Information Technology can aid the transformation process of knowledge.

***Knowledge management** has recently become a fashionable concept, although many organisations are still unable to explain what knowledge is. More importantly, they are unable to develop and leverage knowledge to improve organisational performance.*

*However, many organizations are now attempting to enhance their performance through **Business Process Reengineering** that is a strategy of redesigning business operations to take full advantage of information technology and human resources.*

Now, enterprises should create – entirely – new ways of working to survive in a competitive environment. Organisational transformation depends of the creation of a powerful vision of what future should be like. We claim that an in depth understanding of the current functioning is also required. In this context, enterprise knowledge modelling can help understanding the current business situation and establishing a vision of what the future should be like. Therefore, modelling of enterprise knowledge becomes a pre-requisite for system requirements elicitation and system development.

Keywords: knowledge; knowledge management; reengineering; business process reengineering; enterprise knowledge; modelling of enterprise knowledge

JEL Classification: D83; O33

1. Introduction

Improving productivity and competitive position are critical business issues to both individual organizations and nations. Improved productivity leads to a better standard of living, and an enhanced ability to compete ensures that the organization will survive to provide a secure future for its employees. Over the past decade, continuous challenges have been made to traditional business practices. Rapid market changes such as electronic commerce, deregulation, globalisation and increased competition have led to a business environment that is constantly evolving. Companies change to better satisfy customer requirements, address increasingly tough competition, improve internal processes, modify the range of products and services they offer [Jacobson *et al.*, (1994)].

Data warehousing initiatives, utilising various data mining techniques, have found common place in many business infrastructures for supporting the decision making process. However, as the vast majority of knowledge exists in the minds of employees, the quality of support these provide, especially for intensive queries, is somewhat uncertain [Nemati, Steiger *et al*., (2002)].

Therefore, new systems are required that not only locate, capture, store, share and leverage data and information, but also knowledge.

Knowledge management has recently become a fashionable concept, although many organisations are still unable to explain what knowledge is. More importantly, they are unable to develop and leverage knowledge to improve organisational performance. Is due to organisations becoming increasingly more complex in structure, resulting in knowledge that is fragmented, hard to locate, leverage, share and difficult to reuse [Zack, (1999)].

At the same time, organizations also experience the effects of the integration and evolution of information technology. Information Technology (IT) has long been touted as a means to

improve productivity and competitiveness. However, there is significant evidence that this has not occurred [Roach, (1989)]. One explanation is that past use of IT focused on the automation of established practices. This approach had the effect of enhancing or automating subsystem processes or tasks in the overall process. Many of these old processes evolved with time and contain tasks that do not add value to the product or service. Thus, investment in information technology showed little impact on economic measures of productivity. While information systems continue to serve traditional business needs such as coordination of production and enhancements of services offered, a new and important role has emerged, namely the potential for such systems to adopting a supervisory or strategic support role. **Information and Communication Technologies** (ICT) were thus positioned as a strategic resource that enables automation, monitoring, analysis and coordination to support the transformation of business processes [Grover *et al.*, (1994)].

However, many organizations are now attempting to enhance their performance through **Business Process Reengineering** [Hammer and Champy, (1993)]. Business Process Reengineering (BPR) is a strategy of redesigning business operations to take full advantage of information technology and human resources. In such an unstable environment, information system developers were challenged to develop systems that can meet the requirements of modern organisations. The paradigms of Business Process Reengineering and Business Process Improvement contrast with traditional information system development that focused on automating and supporting existing business processes [Guha *et al.,* (1993)].

In this article, we also examine the reengineering phenomenon, define and describe reengineering, and present many research issues associated with this new approach for transforming organizational operations.

2. A Framework for Enterprise Knowledge

■ Enterprises' requirements and types of management in theory

Before the seventies, companies used the principle of *scientific management* founded by Frederik W. Taylor and were strongly production-oriented. The resulting organisation lead to a vertical division of the activities to be performed and to functional and extremely hierarchical structures.

Since the eighties, companies are nowadays facing huge pressures to improve their competitiveness. Responses to these were restructuring, downsizing and reengineering along with a strong commitment to customer satisfaction. Organisational transformation became then a major issue. In this competitive and evolving market, quality is fundamental to obtain and to keep market share.

In 1980, experts acknowledged that the total management of quality is one of the factors in improved competitiveness. The **Total Quality Management** (TQM) was thus defined as a management method which aims towards long-range success. It is based on collective participation of each member in the improvement of processes, products, services and organisation of the company. Each business process is (re)designed to contribute to the quality of the products and services. The last stage is around the wave of the **Business Process Reengineering** (BPR), proposed by Hammer and Champy [Hammer and Champy, (1993)], which consists of a radical remodelling of the organisation around its processes[1]. The difference between TQM and BPR is that the former deals with continuous change whereas the latter deals with discontinuous, radical change.

A growing body of literature exists in the practitioner sector on reengineering; however, MIS academics have been relatively quiet on the subject. One possibility is that BPR is seen as a fad. However, many new ideas are labelled as fads because management desires the promised results, but is unwilling or unable to endure the investment or effort required to achieve the results. Although a current fad, redesigning business processes to improve performance is a

[1] a set of activities which produces, from one or several inputs, an output valuable for the customer.

legitimate business tool. It is important not to lose the core idea behind the fad: Information technology enables the radical redesign of business processes! The processes an organization uses to develop, manufacture, and deliver products and services to the marketplace provide the core value of the organization. The concept of reengineering traces its origins back to management theories developed as early as the nineteenth century. Frederick Taylor suggested in the 1880's that managers use process reengineering methods to discover the best processes for performing work, and that these processes be reengineered to optimize productivity.

BPR echoes the classical belief that there is one best way to conduct tasks. In Taylor's time, technology did not allow large companies to design processes in a cross- functional or cross-departmental manner. Specialization was the state-of-the-art method to improve efficiency given the technology of the time [Lloyd, (1994)].

In the early 1900's, Henri Fayol originated the concept of reengineering: To conduct the undertaking toward its objectives by seeking to derive optimum advantage from all available resources [Lloyd, (1994)]. Although the technological resources of our era have changed, the concept still holds. About the same time, another business engineer, Lyndall Urwick stated "It is not enough to hold people accountable for certain activities, it is also essential to delegate to them the necessary authority to discharge that responsibility" [Lloyd, (1994)]. This admonition foreshadows the idea of worker empowerment which is central to reengineering.

Although Hammer and Champy are eager to declare that classical organization theory is obsolete, classical ideas such as division of labor have had an enduring power and applicability that reengineering has so far failed to demonstrate. BPR does not appear to qualify as a scientific theory, because, among other things, it is not duplicate and it has limited scope. The applicability of classical management theories, such as division of labor, was widely duplicable and portable. These ideas stimulated increases in productivity, output, and income that led to the creation of the middle class.

If BPR is not a theory, but a technique, Hammer and Champy are surprisingly vague about the details. Despite their vagueness, Hammer and Champy are clear about who to blame when reengineering attempts fail; it is the fault of the individual company. To the steering committee, this sounds like a variation of blaming the victim.

Cyert and March, among others, point out that conflict is often a driving force in organizational behavior. BPR claims to stress teamwork, yet paradoxically, it must be "driven" by a leader who is prepared to be ruthless. One executive with BPR experience warns not to assume "*you can simply issue directives from the center and expect it to happen*".

According to Thomas Davenport, *classical reengineering* repeats the same mistakes as the classical approach to management, by separating the design of work from its execution. Typically, a small reengineering team, often from outside the company, designs work for the many. The team is fueled by assumptions such as "*There is one best way to organize work; I can easily understand how you do your work today; I can design your work better than you can; There is little about your work now that is worth saving; You will do your work the way I specify*." [Chew, (1994)]

Davenport suggests that the engineering model/analogy that BPR is based upon is flawed, both in terms of process design and information technology. He proposes an "ethnographic" approach to process design and an "ecological" approach to information systems, called participative business makeovers which is discussed later in this paper.

BPR is often used by companies on the brink of disaster to cut costs and return to profitability. The danger is that during this process the company may slash its capacity for future growth.

To reap lasting benefits, companies must be willing to examine how strategy and reengineering complement each other – by learning to quantify strategy (in terms of cost, milestones, timetables); by accepting ownership of the strategy throughout the organization; by assessing the organizations current capabilities and processes realistically; and by linking

strategy to the budgeting process. Otherwise BPR is only a short term efficiency exercise [Berman, (1994)].

One of the hazards of BPR is that the company becomes so wrapped up in "fighting its own demons" that it fails to keep up with its competitors in offering new products or services [Cafasso, (1993)].

Another writer urges consultants not to present BPR as a quick fix program since it "may help you save money tomorrow but will leave you in a worse position next month or next year" [Leth, (1994)].

Now, enterprises should create – entirely – new ways of working to survive in a competitive environment. As stated in [Barrett, (1994)], organisational transformation depends of the creation of a powerful vision of what future should be like. We claim that an in depth understanding of the current functioning is also required. In this context, *enterprise knowledge modelling* can help understanding the current business situation [Jarzabek and Ling, (1996)] and establishing a vision of what the future should be like. Therefore, *modelling of enterprise knowledge becomes a pre-requisite for system requirements elicitation and system development*.

Enterprise knowledge modelling refers to a collection of conceptual modelling techniques for describing different facets of the *organisational domain* including operational (information systems), organisational (business processes, actors, roles, flow of information etc), and purposes considerations [Bubenko, (1994)]. Existing enterprise knowledge modelling frameworks [Dobson *et al.*, (1994); van Lamsweerde *et al.*, (1995); Yu and Mylopoulos, (1996); Loucopoulos *et al.*, (1998); Nurcan *et al.*, (1998); Rolland *et al.*, (1998b); Bubenko, (1994); Loucopoulos and Kavakli, (1995)] stress the need to represent and structure enterprise knowledge. However, very few approaches investigate the **dynamic aspect of knowledge modelling**; i.e., how enterprise knowledge models are generated and evolve and how reasoning about enterprise knowledge can guide the organizational transformation. Therefore, *process guidance* concerns the support provided to the enterprise modelling and the organisational transformation. Work in this area mainly focuses on prescriptive approaches. However, due to its social and innovative nature, the organisational change can not be fully prescribed. In fact, the enterprise modelling process in an evolving environment is a decision making process i.e. a non-deterministic process. Accordingly, process guidance should allow selecting dynamically the next modelling activity to be performed depending on the situation at hand [Rolland *et al.*, (1996); Rolland *et al.*, (1997a); Rolland *et al.*, (1999); Rolland et al, (2000)]. EKD-CMM[2] is the confluence of two technologies: *Enterprise Knowledge Modelling* and *Process Guidance*.

Most of the current approaches for modelling enterprise knowledge and organisational change view change management as a *top-down* process. Such approaches (e.g., BPR) assume that the change process starts with a high level description of the business goals for change. The initial goals are then put into more concrete forms during the process, progressively arriving at the specification of the future system requirements that satisfy these goals. Other approaches (e.g., TQM) advocate a *bottom-up* orientation whereby the need for change is discovered through analysis of the current organisational situation and reasoning about whether existing business structures satisfy the strategic concerns of the stakeholders. In the first case, the goals for change are *prescribed* in the sense that they do not explicitly link the need for change to the existing organisational context, rather they reflect how change is perceived from the strategic management point of view or is codified in the organisation's policies and visions. Such goals do not always reflect reality [Anton, (1996)]. On the other hand, in bottom-up approaches, goals for change are *described* i.e., they are discovered from an analysis of actual processes. However, descriptive goals tend to be too constrained by current practice, which can be a serious drawback when business innovation is sought [Pohl, (1996)].

[2] The term EKD-CMM stands for Enterprise Knowledge Development – Change Management Method

■ **Enterprise Knowledge Development – Change Management Method for Business Process Reengineering and Business Process Improvement**

Due to its social and innovative nature, the enterprise knowledge modelling and the organizational change can not be fully prescribed because these are, first of all, decision making processes, therefore non deterministic in nature.

Enterprises that can manage complexity and can respond to rapid change in an informed manner can gain a competitive advantage. EKD-CMM is a method to documenting an enterprise, its objectives, business processes and support systems, helping enterprises to consciously develop schemes for implementing changes. EKD-CMM satisfies two requirements: **1.** assisting enterprise knowledge modelling and **2.** guiding the enterprise modelling and the organisational transformation processes.

The EKD-CMM *enterprise knowledge modelling* component [Nurcan *et al.*, (1999); Loucopoulos *et al.*, (1998); Rolland *et al.*, (1998c); Bubenko, (1994); Loucopoulos and Kavakli, (1995); Nurcan and Rolland, (2003)] recognises that it is advantageous to examine an enterprise from multiple perspectives.

The inter-connected set of EKD-CMM models describing an enterprise are structured in three levels of concern: *Enterprise Goal Model, Enterprise Process Model* and *Enterprise Information System Model*. The first two levels focus on *intentional and organizational aspects of the enterprise*, i.e. the organisational objectives and how these are achieved through the co-operation of enterprise actors manipulating such enterprise objects. The third level, is useful when the EKD-CMM approach is applied to define the requirements for an information system. In this case, the focus is on *system aspects* i.e., the computerised system that will support the enterprise, processes and actors in order to achieve the enterprise objectives.

Therefore, within EKD-CMM, the product is a set of operational (information systems), organisational (business processes) and intentional (business objectives) models describing the new system to be constructed and the organisation in which it will operate. The Product Models used in the two higher levels of abstraction have been previously presented in [Nurcan *et al.*, (2002); Barrios and Nurcan, (2002); Nurcan and Rolland, (2003)]. We list them hereafter to remind their purposes.

a. The *goal models* represent the current or future enterprise objectives. Their purpose is to describe what the enterprise wants to achieve or to avoid.

- **b.** Enterprise business processes, motivated by enterprise objectives, are modelled at the second level according to several points of view. Consequently, *enterprise process models* resulting from these descriptions require different Product Models. Using models to represent the enterprise allows a more coherent and complete description of enterprise objectives, business processes, actors and enterprise objects than a textual description.

These models are useful because they allow **1.** to improve the knowledge about the enterprise, **2.** to reason on alternative solutions and diverging points of view, and **3.** to reach an agreement. They proved their efficiency as well as for improving communication than making easier the organizational learning. The intention based modelling used in EKD-CMM provides basis for understanding and supporting the enterprise modelling, organisational change and helping the development of the supporting information systems. The proposed method can be used for both business engineering and information system engineering purposes, allowing:

a. business process reengineering: from business processes level to the business objectives for change [Rolland *et al.*, (1998b); Nurcan *et al.*, (1999); Nurcan and Rolland, (1999); Rolland *et al.*, (1999b)] and then to the business process architecture for the future;

b. reverse engineering: from legacy information systems to the information system level which may be than used to model the business processes level [Kavakli and Loucopoulos, (1998); Kardasis and Loucopoulos, (1998)];

c. forward engineering or information system design: from business objectives to business process modelling and to the choice of the processes to be supported by the information and communication technologies (ICT) and than to the IS modelling;

d. business process improvement: by modelling and analysing the business processes in order to enhance them by specific modifications such as role definition or activity flow;

e. quality management: by defining the business processes and quality procedures and by aligning them ones with respect to others.

We focus our attention on business processes to understand the current way of working of the enterprise and reasoned on the organisational change at the intentional level [Nurcan *et al.*, (1999); Nurcan and Rolland, (1999); Rolland *et al.*, (1999b)]. The EKD–CMM approach has been thus successfully applied in an European Project (ELEKTRA) aiming to discover generic knowledge about change management in the electricity supply sector for reusing it in similar settings. Two end-user applications have been considered within the project. The common theme underpinning their requirements was their need to deal with change in a controlled way which would lead to an evaluation of alternative options of possible means to meet the objectives for change.

3. Knowledge Management

■ Change in Knowledge Management

Knowledge Management, new as it is, is changing. There are at least three accounts of how it is changing and about how we should view **The New Knowledge Management** (TNKM). One account, by Mark Koenig (2002), sees KM as a field that was originally driven by information technology, the Internet, best practices, and later lessons learned, and most importantly knowledge sharing. This theory sees a second stage of KM as about human factors, organizational learning, and knowledge creation viewed as the conversions among tacit and explicit knowledge. The third stage of KM is the stage of the arrangement and management of content through taxonomy construction and use, and like the first is also heavily biased towards information technology.

The second view of change, by David Snowden (2002), is a bit more subtle than the first. According to this theory, the first age of knowledge management is one in which the word knowledge itself was not at first "problematic," and in which the focus was on distributing information to decision makers for timely use in decisions. The second age replaced the information technology focus with one on tacit/explicit knowledge conversion inspired by Nonaka's SECI model. It is just ending. Snowden contends that the third age *will be* one in which: knowledge is viewed paradoxically as a thing and a flow; context, narrative and content management will be central to our view of KM; Further, he believes that there will be an understanding of organizations as engaged in sense making through utilization of complex adaptive systems (CAS) phenomena constrained by human acts of free will attempting to order them; and finally, the use of the insights and practices of scientific management will be restricted to appropriate contexts, while "insights and learnings" from theories of chaos and complexity will supplement them in contexts where these new insights are relevant.

The third view of change, first presented by Mark W. McElroy (1999) based on work hosted by the Knowledge Management Consortium International (KMCI) and continuing partly under its auspices since then, views first generation KM, also called "supply-side KM," as primarily about integrating ("supplying") previously created knowledge through knowledge distribution, sharing, and other integrative activities. It is typically associated with two well-known phrases that serve as the mantras for advocates of the 'knowledge sharing' side of KM*:* (1) *It's all about capturing, codifying, and sharing valuable knowledge*, and (2) *It's all about getting the right information to the right people at the right time.* The third view sees second generation KM as first appearing in the mid-90s and as being focused not only on "supply-side" knowledge processing such as knowledge sharing, but also on "demand-side" knowledge processing, or "knowledge-making" in response problem-induced demands. This combined focus on knowledge integration and knowledge production is the defining characteristic of second generation KM (SGKM), or alternatively, The New Knowledge Management (TNKM). But an important aspect of it is also the recognition that organizations are permeated with

complex adaptive systems phenomena, and that knowledge management in them is about using KM to enable or reinforce self-organization in knowledge processing for the purpose of achieving sustainable innovation in support of organizational adaptation.

Comparing this third view to the other two, we can see important differences. The Koenig view, as we have said, presents an ad hoc classification scheme in which the three "stages" of KM are based more on anecdote and personal observation than on any sort of underlying conceptual framework related to knowledge processing and how it is practiced. The third, generational view, by contrast, relies explicitly on a vision of social knowledge processing, against which all forms of practice in KM can be seen and understood, both backwards and forwards in time. Indeed, it is SGKM that is associated with a formal articulation of this vision for just this purpose. That articulation is the Knowledge Life Cycle framework, or KLC, as developed and refined by Firestone [See, for example, Firestone, (1999c, 2000, 2000a, 2000b, 2001, 2002), McElroy (1999, 1999a, 2000a, 2000b, 2002, 2002a)], and other members of the Knowledge Management Consortium International [Cavaleri and Reed, (2000)] over the past four years. The KLC framework is illustrated in Figure 1.

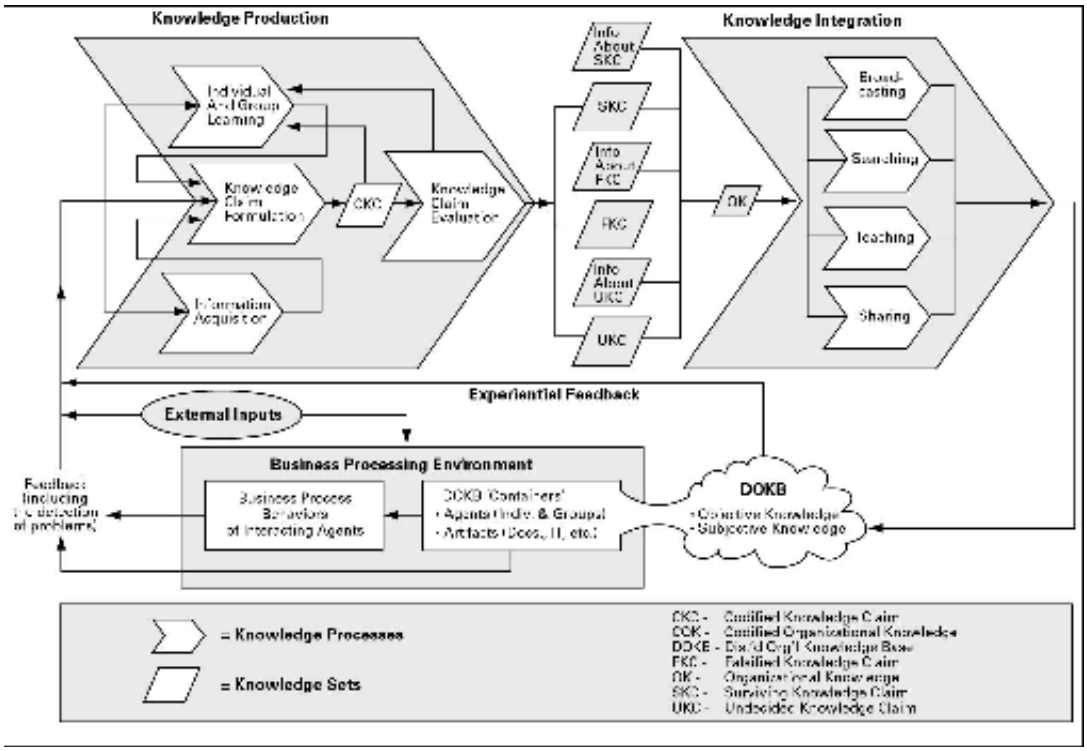

Figure 1. The Knowledge Life Cycle (KLC)

So in light of these contrasting views the questions arise: which of the three views is correct? Are there two generations, stages or ages of KM? Is a third age about to begin? Or are there already three? Are the changes best seen as occurring along the information technology dimension? Or along linguistic dimensions such as taxonomy construction, context, and narrative? Or just in terms of the popularity of different intervention types from one period to another? Or is change in KM best viewed as occurring in terms of the shifting focus of management on the scope of knowledge processing as identified by McElroy?

4. Knowledge Management for Business Performance Improvement

The section focuses on the explication of knowledge and technology that can contribute to provide in capturing, coding, retrieval, sharing and leveraging of different forms of knowledge, as well as different types of knowledge, across an organisation. It raises a number of questions. What is explicitly codified knowledge and how should it be managed?

What role can technology play? How should an organisation's resources and capabilities be configured? The goal of these questions is to provide the decision-maker with a suitable analysis platform for decision-making that enhances all phases of the intra-organisational knowledge management process.

■ **The Knowledge Transformation Process**

As stated earlier, knowledge goes through a transformation process, which can be facilitated through the utilisation of **Decision Support Systems** (DSS), **Artificial Intelligence** (AI). The paper covers the main area of focus, the explication of knowledge, with further detail of this transformation process to be found in the following reference [Nemati, Steiger *et al*. (2002)].

DSS are IT and software specifically designed to help people at all levels of the company, below the executive level, make decisions. DSS can play an important role in the transformation process of explicating knowledge, for example, through the specification of mathematical modelling. Specifically, the goal of these models, and of the decision variables, must be explicitly articulated by the decision-maker. Furthermore, the decisionmaker must also explicitly articulate the model constraints. This specification of explicit knowledge "represents the tacit knowledge the worker has developed over time, within the decision-making environment" [Nemati, Steiger *et al*. (2002)].

DSS can further enhance the explication of knowledge by "eliciting one or more what-if cases, representing areas the knowledge worker would like to investigate" [Nemati, Steiger *et al*. (2002)]. In effect, the tacit knowledge of historical decisions is transformed into explicit form, to be shared and leveraged for improved decision making.

Once this knowledge has been transformed and stored, it can be leveraged by making it available to others when and where they need it. [Nemati, Steiger *et al*. (2002)] suggests that "explicit knowledge stored in the form of instances of a mathematical model (what-if cases) can be leveraged via deductive and/or inductive model analysis systems". Model-specific knowledge is applied to a single instance of a model, addressing such questions as "why is this the solution?," "why do the solutions to two model instances differ so much?".

DSS can also help workers to learn, i.e. the process of converting explicit knowledge to implicit knowledge. Known as internalisation, this process involves the "identifying bodies of knowledge relevant to the particular user's needs" [Warkentin, Sugumaran *et al*. (2001)]. It involves extracting knowledge and filtering it to match a particular problem against the body of knowledge. Internalising explicit and/or new knowledge may arise through a decisionmaker modifying his/her internal mental model that is used as his/her performance guide for a specified situation [Nemati, Steiger *et al*. (2002)].

If tacit knowledge has the potential to be explicated but cannot be articulated, it represents an opportunity lost to utilise that knowledge for enhancement of the decision making process. Competitors who are able to achieve this task may gain a competitive advantage [Zack, (1999)]. This knowledge may remain tacit due to the organisation possessing no formal model or language for its articulation. In contrast, inherently inarticulable knowledge that organisations attempt to articulate may have a detrimental effect on organisational performance, as this knowledge may ultimately be lost. Tacit knowledge is an extremely important resource as it underpins the decisions workers make for a given situation. Failure to manage it properly will lead to a loss of knowledge and failure to benefit from the experience of others.

Although explicit knowledge represents a fraction of an organisation's intellectual assets, it is apparent it plays a crucial role in the knowledge strategy of an organisation. Zack (1999) suggests that "appropriately explicating tacit knowledge for sharing and reapplication is the least understood aspect of knowledge management". However, organisations must not shy from this process as the balance between tacit and explicit knowledge can impact the competitive performance of an organisation. Organisations should therefore focus on determining which

knowledge to make explicit and which to remain tacit. Providing a suitable set of guidelines for managing this knowledge is the key to success for any knowledge management initiative.

■ Inter-Organisational Knowledge Sharing

The paper has so far discussed how knowledge can be managed to support decision-making within an organisation. We will now discuss how the emergence of new technologies can enhance an organisation's relationship with its stakeholders. The final part of the paper will address how new technology, specifically web-enabled, can enhance the utilisation and leveraging of knowledge, for inter-organisational knowledge sharing. We examine the way organisations are restructuring internal and external relationships, and creating "e-knowledge networks", existing in a virtual environment, to facilitate the communication of data, information and knowledge.

Much like an intra-organisational knowledge warehouse, the combination of knowledge networks and the Internet effectively create one, whole virtual repository, allowing all participants to create, share and use strategic knowledge to collaboratively improve operational and strategic efficiency and effectiveness. The primary focus of this integrated, virtual community is centred on the explicit knowledge contained in the repository, rather than the providers, decision-makers or the tacit knowledge they may hold [Zack, (1999)].

In addition to capturing, storing and retrieving information, an organisation must be able to lever this information to specific processes and unknown situations. Specific contextual knowledge must be fully exploited to reflect the full range of organisational knowledge, as it can provide significant opportunities for competitive advantage.

A community of practice is defined as "an informal group where much knowledge sharing and learning takes place" [Merali and Davies, (2001)]. In essence, the group acts like an informal network, with each participant sharing a common agenda and interest. The importance of these networks becomes apparent when individuals attempt to elicit information from others who do not share common interests and agendas.

- "Communities of practice and social networks highlight the importance of the link between social capital and knowledge resources" [Merali and Davies, (2001)].

Most knowledge management initiatives attempt to capture information relating to specific user profiles and queries. However, "the bigger challenge is to capture and reuse knowledge that is generated during knowledge work" [Merali and Davies, (2001)]. Although DSS can effectively manage this created knowledge in a number of ways. Merali [Merali and Davies, (2001)] suggests that the majority of knowledge created through this process generally tends to remain private. This is due to the following:

- "A lack of context within which to articulate individual learning" [Merali and Davies, (2001)].
- "The amount of time and effort required to analyse and record what has been learnt" [Merali and Davies, (2001)].
- "Articulating particular types of knowledge may not be culturally legitimate, challenging what the organisation knows may not be socially or politically correct" [Zack, (1999)].
- "Making private knowledge public may result in a redistribution of power that may be resisted in organisational cultures" [Zack, (1999)].

Communities of practice are seen as a means to overcome these barriers to knowledge sharing. We now discuss how e-knowledge networks, supported by the Internet, can enable the creation of a "virtual community of practice" [Merali and Davies, (2001)].

Inter-organisational systems are "networks of company systems that allow organisations to share information and interact electronically across organisational boundaries" [Warkentin, Sugumaran *et al*. (2001)], the common medium being the Internet. Organisations are now adopting a fresh approach to knowledge, that is, "knowledge equals power, so share it and it multiplies" [Verna, (2000b)]. Their aim is to increase efficiency and speed of response in rapidly

changing markets and improve an organisation's relationship with its stakeholders [Walsham, (2001)].

E-knowledge networks are formed through the combination of knowledge management and inter-organisational systems. The adoption of the Internet has provided a platform for the continuous and unattended exchange of information and knowledge about markets, customers, demand, inventories and so forth. These platforms enable the sharing of valuable knowledge, often created through technologies such as decision support systems, intelligent agents and data warehouse technologies, with their strategic partners, thereby enabling improved organisational effectiveness. One such example of intelligent agents is the Jasper II system, comprising intelligent software agents that "retrieve, summarise and inform other agents about information considered to be of value to a Jasper II user" [Merali and Davies, (2001)].

It is quite apparent organisations need to be flexible and be able to identify exploitable situations. These goals can be achieved by implementing electronic systems that generate immediate knowledge (real time) about internal functions and processes, customers, markets, supply chain partners, vendors and dealers [Warkentin, Sugumaran *et al*. (2001)]. Furthermore, a strategic relationship should provide access to different sources of knowledge, not duplicates of this knowledge [Day, Schoemaker, and Gunther *et al*. (2000)]. Such systems allow organisations to be dynamic and flexible, allowing rapid changes in their strategies and activities. Organisations can use this knowledge to create new internal and external structures and relationships, leading to further improvements in knowledge, leading to further strategic improvements.

■ e-Knowledge Networks for Business Improvement

We will discuss one long-term alliance, suggested by Warkentin [Warkentin, Sugumaran *et al*. (2001)], as a trend likely to develop from implementing strategic e-knowledge networks in the context of supply chain. The supply chain process involves organisations acquiring resources and providing goods or services, [Johnson and Scholes (1999)]. Progressive supply chain management aims to improve the co-ordination "across the supply chain to create value for customers, while increasing the profitability of every link in the chain" [Warkentin, Sugumaran *et al*. (2001)]. It is this co-ordination aspect that addresses the role of shared knowledge, enabling the analysis and management of all supply change activities. In other words according to Choi *et al*. [Choi, Budny *et al*. (2004)] the supply chain involving knowledge is referred to as knowledge supply chain and in this context they define knowledge as technologies, inventions and know-how that helps businesses bring products to markets. The material flow is the physical flow of material and the knowledge flow is like the flow of technique that connects the parts together.

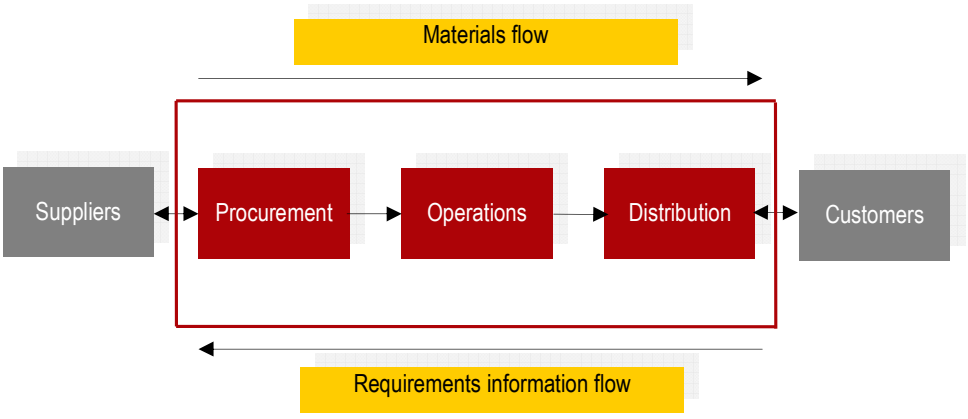

Figure 2. A Typical Supply chain

Figure 2 illustrates a material flow in a typical supply chain. It shows how material moves from supplier to customers' and at every stage a value is added to the material, whilst, a network

generates value not just through goods, services and revenue, but also through knowledge. Knowledge becomes a medium of exchange in its own right, with success dependent on building a rich web of trusted relationships. The supply chain network proposed by Warkentin [Warkentin, Sugumaran *et al*. (2001)] is extended to emphasise the creation of a value network for a complex e-business environment. In support of this trend towards e-networks, additional focus has been given to the implications on the value chain. Verna [Verna, (2000b)]states "the traditional view of value chain is outdated by the new enterprise model of the value network".

Before the introduction of the Internet, the traditional view of the supply chain was that of inefficient communication and allocation. Information flowed in a linear fashion, either upstream or downstream. In addition, a further drawback was the lack of connection to one's customers, as organisations were forced to communicate through wholesalers, distributors and retailers. Dispersion of information beyond one link in the supply chain was inhibited through a lack of formal relationships. Furthermore, the "information flow through linkages was constrained due to a lack of standard data representation schemes, therefore, the sharing of information beyond immediate supply chain partners was impossible" [Warkentin, Sugumaran *et al*. (2001)].

The traditional view of knowledge was to hoard it and If organisations were to share this valuable information, a competitive edge would be lost [Verna, (2000b)]. However, the consensus among new economy organisations is to provide an open environment for the sharing of information. Organisations are encouraged to work "in close co-ordination to optimise the flow in the entire supply chain" [Warkentin, Sugumaran *et al*. (2001)].

The concept of the e-supply chain proposes a new relationship between suppliers, partners and customers as well as integration of processes, information systems and interorganisational problem solving [Manthou, Vlachopoulou *et al*. (2004)]. The e-supply chain is the backbone of a virtual network, linking each participant as one cohesive unit. The chain comprises a series of value-added stages, starting with the supplier and ending with the consumer. The focus of the e-supply chain is on the bi-directional flow of information, each stage is a supplier to its adjacent downstream stage and a customer to its upstream stage.

Each participant is therefore able to assume many roles within the supply chain, but the ultimate relationship comes down to a supplier and a customer role.

Traditionally, demand information passed through many layers, with each layer degrading the quality of information. The variances in this information caused poor production scheduling and inefficient resource allocation, resulting in excessive inventory throughout the chain [Warkentin, Sugumaran *et al*. (2001)]. In contrast, the e-supply chain proposed by Manthou [Manthou, Vlachopoulou *et al*. (2004)] utilises information and knowledge as a substitute for inventory, competing on agility and speed and viewing customer collaboration as a competitive, strategic asset. Figure 3 illustrates the creation of knowledge in an organisation. Here, it is argued that a typical organisation is closed loop i.e., it can acquire knowledge through external factors only. But it must be emphasized that effectively managing and retrieving the existing knowledge – which could be in the form of data and expert's knowledge – should be the main focus.

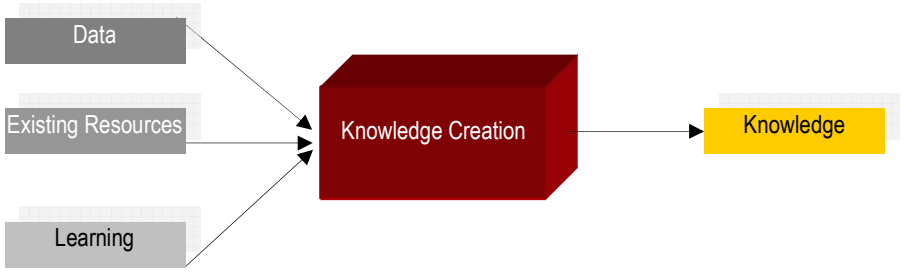

Figure 3. Knowledge Creation

Knowledge creation would ensure by helping the organisation in identifying skill gaps or knowledge gaps between what an organisation has as a whole and what it may need to face new

challenges. It would also make it easy to identify what areas an organisation should either focus on or outsource its activities to. It must be emphasized that just leveraging knowledge in an organisation may not be enough because of the dynamic and ever changing world we are in. And so, this should be complemented by inculcating a learning environment by fostering and rewarding individuals. The key to a successful organisation is how effectively it brings together the skills it possesses.

The resulting fresh flows of strategic supply chain knowledge lead to new strategic relationships in the e-marketplace. These flows may represent "knowledge created by analytical processes conducted by automated data mining algorithms" [Warkentin, Sugumaran *et al*. (2001)]. What is most significant about e-knowledge networks is that they permit fresh inter-organisational information and knowledge flow, effectively facilitating management of the supply chain. However, if an organisation is to gain maximum benefit from these newly created flows of information and knowledge, they must use it strategically.

■ Knowledge Management and firm performance

Knowledge that supports the decision making process is an obvious vital resource, however, knowledge has often suffered from under management in the past. It is only in recent years that knowledge has been taken more seriously. This no doubt resulted from a poor understanding of what knowledge is and from a lack of provision, in terms of guidelines and frameworks, for managing it.

The concepts of KM and innovation. This research study builds on the definitions of KM of Takeuchi and Nonaka (2004), Uit Beijerse (2000), Von Krogh *et al.* (2000), Uhlaner and Van Santen (2007) and Blom *et al*. (2006).

The conceptualization of KM overlaps to some extent with other literatures, including that of organization learning [Scarbrough and Swan, (2001)] and innovation. KM is a relatively new concept, by comparison, but the advantage of using this paradigm is that it provides a means to integrate a number of processes that have been loosely coupled in past research, in particular, by thinking of knowledge as a flow that follows the familiar model of input, throughput and output [Hendrickson and Psarouthakis, (1998)].

Although research on KM continues to grow, there appears to be a lack of consensus about the actual components or phases of KM, other than the recognition that it is a process which begins with a flow of information both from outside the organization and from an internal creation process amongst individuals within the firm and also involves some type of throughput and output processes which if successful result in innovative firm behaviours. It is possible however, to identify from different authors, phases which appear to parallel the inputthroughput-output paradigm used rather extensively in open systems theory [Hendrickson and Psarouthakis, (1998)]. Thus, first, in most KM models, there is an acknowledged "acquisition" phase, in which the organization obtains knowledge both internally (for instance, from internal research and development activity) and externally, including, for example, hiring new employees [Holsapple and Jones, (2004)], strategic alliances, or going to presentations or seminars [Uit Beijerse, (2000)].

A second general category of KM strategies relate to the transformation or hroughput phase—for instance, *sharing* knowledge—i.e. disseminating knowledge in the organization and *storing* knowledge—codifying and documenting knowledge [Wong and Aspinwall, (2005), Oshri, (2005)] or what Huber (1991) refers to as organizational memory. Data warehousing is one example of a storage practice identified by Von Krogh *et al.* (2000). Data warehousing refers to a system which holds or stores knowledge, in repositories of books and manuals, KM systems (KMS), ERP and/or other information management systems (both computerized and non-computerized). Not all sharing and storage requires ICT technology or even lends itself to ICT. In particular, non-ICT solutions are thought to be particularly important to share and store *tacit* knowledge, that is, information that is not easily codified and thus cannot be recorded, stored (or transferred) by a written or electronic database [Davenport and Prusak, (1998)]. Tacit knowledge

is typically and perhaps most effectively shared directly between individuals, either through conversation or direct observation. When formalized, it has been referred to as a *knowledge audit* [Von Krogh *et al*, (2000)], that is, discussions among colleagues to share information (especially laterally in the organization) [Davenport, De Long and Beers, (1998)].

The third phase of KM has been variously referred to as the application [Blom *et al*, (2006)], enabling [Von Krogh *et al.*, (2000)] or emission of knowledge [Holsapple and Jones, (2004)]. Although theoretically this can be seen as the "output" aspect of KM, in practice, evidence of knowledge applications often look quite similar to innovation, whether as new patents, products or processes. In an extensive qualitative study, Blom and colleagues find that in fact, respondents have a difficult time differentiating between the concept of enabling and innovation output more generally [Blom *et al*, (2006)]. For the purpose of this article, thus, the output phase of KM is considered the same as innovation performance, and is evidenced by the number of new processes and products, as well as patents within the organization.

■ Rationale and hypotheses

KM is generally viewed as a process-oriented perspective that reflects strategies to acquire or create knowledge, either externally or internally, secondly, to access, share store or maintain knowledge within the firm, and finally to apply knowledge [Lee and Choi, (2003); Alavi and Leidner, (2001), Sabatier *et al*, (2005)]. For the purpose of the present article, we suggest that processes that assist in acquisition of knowledge from outside the organization and creation of knowledge internally be referred to as *KM input strategies*. Strategies that address sharing, codification and storage of knowledge within the firm will be referred to henceforth as *KM throughput strategies*. Although in the literature, an attempt has been made by Von Krogh *et al.* (2000) for instance to identify enabling strategies, in research carried out and reported on by Blom *et al.* (2006), it was found difficult to clearly differentiate enabling strategies from throughput strategies on the one hand, and innovation performance, on the other. Thus, for the purpose of the present study, rather than try to identify KM output strategies, we consider "outputs" such as rate of innovation (new products, processes and patents) as overlapping the output phase of the KM model. In the present article we will investigate whether various measures of these different KM strategies (i.e. KM input, throughput and output) are related to firm performance of small firms. See Figure 4 for a simplified model. A limited number of control variables are shown in Figure 4 and used in the present research, including company size, company age, sector, and employment growth.

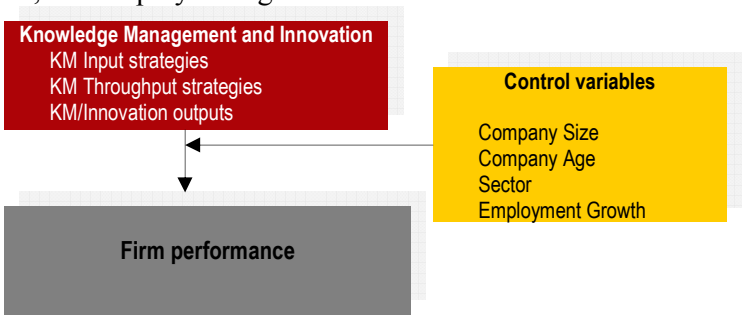

Figure 4: A simplified model of knowledge management, innovation and firm performance

The relationship between KM input strategies and firm performance. In her seminal work, and referred to as the resource-based view, Penrose (1995) argues that it is the ability to create knowledge that helps to explain the firm's ability to grow. Although in theory, companies may acquire knowledge both internally and externally, past research on SMEs reveals that the greater part of knowledge that SMEs acquire comes from outside the firm: from suppliers, colleagues and competitors, as well as clients. The knowledge infrastructure within the firm is used to only a very minor degree for acquiring knowledge [Kerste and Muizer, (2002), Prince and Becht, (1999)]. Cohen and Levinthal (1990) suggest that external knowledge in particular increases the

absorption capacity of a firm by forcing a reconfiguration of existing knowledge. Nevis *et al*. (1995) suggest that learning is greater when more assorted interpretations are developed by the organization. Strategic alliances are one way to bring more information into the organization [Cegarra-Navarro, (2005)]. Cegarra-Navarro (2005) concludes such alliances stimulate organizational learning. Such learning is found to be associated, in turn with better firm performance in recent research by Spicer and Sadler-Smith (2006).

Caloghirou *et al* (2004) in their empirical research, find a link between strategic alliances, and reading science and business journals, in particular, and the extent of innovation, but do not test for direct links with sales growth. Resources such as the ratio of R&D employees to total employees are also linked to sales growth from new products in their study. Desouza and Awazu (2006), in a qualitative study, identify strategies followed by SMEs in particular.

They support a claim by Robinson (1982) that SMEs have a knack for exploiting foreign (i.e. external) sources of knowledge, and that larger organizations are less apt to exploit these same sources [Prahalad and Ramaswamy, (2004)]. In a study of the effects of technology cooperation with outsiders (e.g. industry, laboratories, universities, strategic alliances), Sher and Yang (2005) find that sector has an important moderating effect. Thus, cooperation is positively associated with return on assets for IC design firms only. This also holds for the effects of research and development intensity (that is, the ratio of R&D experience to the total number of employees). The overall amount of quantitative empirical research linking knowledge acquisition or KM input strategies and firm performance is fairly limited, and is hampered by lack of consistent controls for sector or size differences, small sample sizes, and different operationalizations for both the independent and dependent variables. Nevertheless, the theory on absorptive capacity, and link with the resource-based view lead us to propose the following first hypothesis:

Hypothesis 1: SMEs which rely upon KM strategies to acquire knowledge for the firm, socalled "KM Input" strategies," are likely to grow more quickly than those firms not using such strategies.

The relationship between KM throughput strategies and firm performance. A second set of KM strategies refer to the distribution and modification of knowledge within the firm, including sharing, codification (from tacit to explicit), and storage. These strategies include a combination of ICT and non-ICT approaches. Research regarding the benefits of such strategies is less clear. There is limited research on testing the relationship between KM strategies and financial performance, even less on research specifically involving sales growth. However, drawing from organizational learning theory, the assumption has often been made that effective acquisition and utilization of new knowledge is a source of flexibility, adaptability and competitive advantage [Stata, (1989), Spicer and Sadler-Smith, (2006)], and hence associated with better organizational performance. Though labeling their variable organization learning, Spicer and Sadler-Smith (2006) examine the influence of a learning orientation and sales growth, finding some(weak) support for the relationship between the two variables, especially the degree to which information is shared with employees as well as worker involvement in renewal activities (which is similar, to some extent to the organizational learning concept).

The findings of Spicer and Sadler-Smith (2006) aside, other authors are fairly equivocal about the expected positive effects of KM throughput strategies. For instance, Shin (2004) points out that sharing of knowledge involves not only benefits but also costs. Implementing many types of KM infrastructures requires a substantial financial and nonfinancial investment (Shin, 2004). Formal mechanisms are also insufficient to transfer tacit knowledge [Makhija and Ganesh, (1997); Cegarra-Navarro, (2005)], which may embody more of the unique capabilities of the firm. Desouza and Awazu (2006) also question, especially for SMEs, the importance of formal techniques for sharing information. In their qualitative study, they find that SMEs typically have deep levels of common knowledge. Each employee has a very similar foundation and grounding in organizational matters. Perhaps given the smallness of size, such information is

easily transferred. In short, sharing, codification and storage strategies may be less important in SMEs because basic knowledge is often quickly shared. Nevertheless, since in the process models of KM, throughput strategies involving sharing, codification and storage are frequently mentioned as part of the overall KM model, and thus perhaps also key to the absorption capacity of the firm, we posit the second hypothesis as follows:

Hypothesis 2: SMEs which rely upon KM strategies to distribute knowledge for the firm (through sharing, codification and storage), or so-called "KM Throughput" strategies," are likely to grow more quickly than those firms not using such strategies.

The relationship between KM output (innovation performance) and firm performance. The final set of variables reflects the extent to which the SME is able to apply new knowledge—i.e. the rate of innovation within the firm. This can be viewed either as knowledge output, or in the context of the innovation literature, as innovation performance. Although some authors have attempted to identify "enabling strategies" separate from the knowledge input and throughput strategies described above, in practice, it has been rather difficult to separate the two [Blom *et al*., (2006)]. For the present study, we thus adopt the approach of identifying elements of innovation performance (that is, patents, improvements in process or new products), as evidence of a successful knowledge output strategy, henceforth, to be referred to as "knowledge outputs".

Research linking innovation and performance is inconsistent (Freel, 2000). A variety of studies have examined the link between new product innovation and sales growth. Some research supports the claim that innovation is positively associated with rapid growth within small firms [Storey, (1994); Geroski and Machin, (1993); Roper, (1997); Wynarczyk and Thwaites, (1997); Moore, (1995)]. Heunks (1998) examines the link between changes in production marketing and research and development and growth in sales, finding a significant positive relationship for SMEs between 10 and 50 full time equivalents (fte) but not for those between 51 and 200 fte. In more recent research, Hall and Bagchi-Sen (2002) find a positive relationship between new product introduction and redesigned products and total revenue growth, but only within the biotechnology sector. Some of the inconsistencies in past research can be explained by comparing innovators and non-innovators in different sales turnover growth categories.

In particular, Freel (2000) finds a nonlinear relationship such that non-innovators are more prevalent in declining, stable and (low to average) growth categories, but that innovators exceed non-innovators in the "super-growth" category, that is, firms that are in the highest quartile with respect to sales turnover growth.

Regarding the use of patents, past research is also somewhat inconclusive due to mixed findings. Arundel (2001) points out for instance that patents are seen as less valuable than secrecy in protecting new innovations. The trend is even stronger among small firms. Arundel (2001) concludes that patents are relatively unimportant as appropriation methods in many sectors.

Calantone *et al* (1995) find a positive correlation between several innovation performance variables including new product development, product improvement and new product introductions, and return on sales growth. However, they address a small sample (n=65) in one industry (office and residential furniture) and with companies with at least $10 million in sales. Further, they don't control for size or employment growth. Caloghirou *et al*. (2004) also examine the effects of innovation on growth but their sample includes firms with up to 1250 employees, well beyond any definition of SMEs. Finally, in a rather carefully conducted study, Ernst (2001) finds that patents are positively related to sales increases given a two to three year time lag. However, again, their sample is small (n=50) and restricted to a fairly technical sector (machine tool manufacturing). Hall and Bagchi-Sen (2002) examine the relationship between patents and total revenue growth for biotechnology firms but they find no statistically significant relationship. On balance, it is difficult to draw clear conclusions from the extant research on knowledge outputs due to the lack of consistent controls for sector and size, and due to wide

variation in definition and measurement of firm performance. Nevertheless, some research does point to the conclusion that innovation matters. Thus, we state hypothesis 3 as follows:

Hypothesis 3: SMEs which report knowledge output, via various innovation indicators, are likely to grow more quickly than those firms who do not report such output.

Size as an important control variable. The resource-based view [Penrose, (1995)] argues that when a firm grows in size, it will reorganize its resources to take advantage of more obvious opportunities for specialization. Specific to KM, the firm's size as measured by number of full time employees is also positively correlated with the collection of information [Mohan-Neill, (1995)]. Even for a relatively small sample, Uhlaner and van Santen (2007) find evidence for a positive relationship between size and formalized KM practices. However, in the extant literature on innovation, some contradictory results are found for several hypothesized effects. In particular, some of the size effects may only start to work for larger firms. Previous studies have also shown non-linear size effects [e.g. Cohen and Levinthal, (1989), Lööf and Heshmati, (2006)].

The relationship between size and company growth is also controversial and dates back to Schumpeter (1942). Some findings would suggest that innovation tends to grow at a rate less than proportional to firm size. That is, as a firm increases in size, it grows at an ever decreasing rate [Stock *et al.*, (2002). Stock *et al*., (2002)] find a negative relationship between size and dynamic innovation performance, i.e. the rate of change of new product technology performance.

Furthermore, a range of earlier studies point at the size dependence of determinants of firm performance, particularly in relation to strategic renewal and innovation efforts [e.g. Kemp *et al.*, (2003) and Cohen and Levinthal, (1989)]. Therefore, it is important to control for size effects when exploring the relationship between various aspects of KM and firm performance.

5. Business Process Reengineering – Analysis and Recommendation

To remain competitive in the increasingly cutthroat global marketplace, companies will constantly need to examine the effectiveness and efficiency of their processes. Information Technology (IT) allows organizations to reexamine the assumptions upon which they built their processes and provides the potential for radical redesign. Further, with the rate of technological change, new products will continually enable new and improved process designs. Thus, to remain competitive, and perhaps to remain in business, organizations need to periodically reengineer their core processes with current technology.

5.1. The Reengineering Phenomenon

■ Reengineering as a Concept

Business process reengineering (also termed process innovation, business process redesign, etc.) is an effort to redesign the organization for improved efficiency and effectiveness by focusing on the processes used in daily operations rather than on the traditional functions performed by the business. More precisely, according to Hammer and Champy, "Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service, and speed (1993, p. 32). Business process reengineering, often cross-functional and always radical, is a one-time project aimed at drastic redesign. The goal of BPR is dramatic improvement in process performance and process improvements in the 50 to 1000 percent range [Davidson, (1993)]. In contrast, Total Quality Management efforts often lead to incremental improvements. Baldrige Award winners demonstrate an average of 5 to 12 percent [Davenport, (1993)].

Important to understanding business process reengineering is understanding what it is not. Business process reengineering is not business transformation. Business transformation refers to any effort to redefine or reformulate the organization's strategy or philosophy [Davidson, (1993); Boynton, Victor, and Pine, (1993)]. Business process reengineering focuses on redesigning

processes to support strategy and objective attainment rather than on examining or redesigning the strategy or objectives. Business process reengineering is not systems reengineering. Systems reengineering is redesigning the computer architecture upon which the organization's systems are built. Systems reengineering includes downsizing or rightsizing (e.g., migrating to a client/ server architecture from a mainframe architecture), code restructuring, or migrating systems to more efficient languages. As we mentioned before, an organization may have to go through a systems reengineering effort before it can implement business process reengineering. Most importantly, business process reengineering is not **Total Quality Management** (TQM). BPR is similar to TQM because both take a process view of the organization and both focus on the customer as a major source of process measurement. However, TQM focuses on continuous, incremental improvement of those processes through employee and customer feedback. BPR attempts to totally redesign the process from the ground up. It uses a paradigm of a "clean sheet of paper," or starting over from scratch, rather than improving the existing situation [Hammer and Champy, (1993)]. Further, TQM is a continuous process with strong tools and methods, while BPR is a one-time project with few proven tools and methodologies. Finally, BPR considers information technology and human resources as prime enablers of major changes, while TQM does not rely heavily on IT for its process improvements. Reengineering has the potential to elevate information technology to its promised level as a business tool with the ability to have a major impact on the bottom line. Perhaps the greatest contribution of reengineering is that information technology's potential is being recognized (and in some instances, embraced) by those outside its traditional boundaries. Many executives are realizing that organizations that use technology effectively and creatively as the basis for the design of their core operations will outperform those organizations that do not. However, to sustain the current focus on process reengineering through information technology and to ensure a higher probability of success, much needs to be learned about the phenomenon. If the majority of organizations continue to have difficulty attaining the lofty goals of process redesign, they will not continue the BPR effort. Many questions need to be answered to help reengineering become an effective business tool. Important issues of BPR that need to be addressed are identified and discussed in the following sections.

REENGINEERING QUESTIONS
When should reengineering be done?
How should a reengineering project be performed?
What should be done to ensure the success of a reengineering project?
What is the role of information technology and the information systems staff?
How will reengineering affect the relationship between business and society?

When should reengineering be done? Identifying when an organization should initiate an effort to redesign its processes is difficult. Measuring process improvement and assessing process health are important issues. Obviously, a poorly performing process should be redesigned. The problem is identifying the poorly performing process. Ambiguous objectives and unclear process metrics often make this assessment difficult. Davidson (1993) suggests five operating performance measures: productivity, velocity, quality, business precision, and customer service. However, determining which measure is the most relevant to the current process and operationalizing the measure for the process is a problem. Hammer and Champy (1993) suggest **three criteria for choosing processes to reengineer**:

1. Which processes are having the most trouble?
2. Which processes have the greatest impact on customers? and
3. Which processes are the most susceptible to redesign?

Again the problem lies in actually assessing a process in these terms. Another issue is the appropriateness of today's technology for redesigning the process. Should the process be redesigned with the current technology? Should the redesign effort look to near future technologies? Should a premium be paid for the latest and the greatest technology? These issues suggest the need for developing effective process measurement tools and criteria, as well as

guidelines for assessing current and future information technologies and their potential impact on business processes. The situation is further complicated because many firms are not process oriented. They think in terms of functional organizations and frequently do not have a process owner who is responsible for a complete process. Before they can decide which process to reengineer, they need to define and map their processes. Davenport (1993) developed a set of generic processes (e.g., research processes, sales processes, manufacturing processes). Some authors suggest that most companies should have between six and fifteen such processes [Hammer and Champy, (1993); Davenport, (1993)].

What is the optimal number of processes? If there are only a few generic types of processes, should management education focus on process management rather than functional management? What are the characteristics of effective process management?

How should process management be taught? Should one restructure into a process environment before attempting to reengineer? These are a few of the questions surfacing due to this new focus on organizational processes as the firm's foundation of core value. The organizational climate also may be an important factor in the decision to redesign a process. Should reengineering be done at a relatively quiet time in the company's operations? Or, is the chance of success greater when the company faces a crisis and all involved recognize the need for change? Should reengineering be a continuing process in the organization (e.g., each process is reviewed every three years)? Much of the current lack of success of BPR may be the result of an organization reengineering because of the promise of Eden rather than because of a realistic assessment of its needs. Guidelines for timing reengineering projects and for assessing company culture could vastly improve the probability of success of reengineering projects.

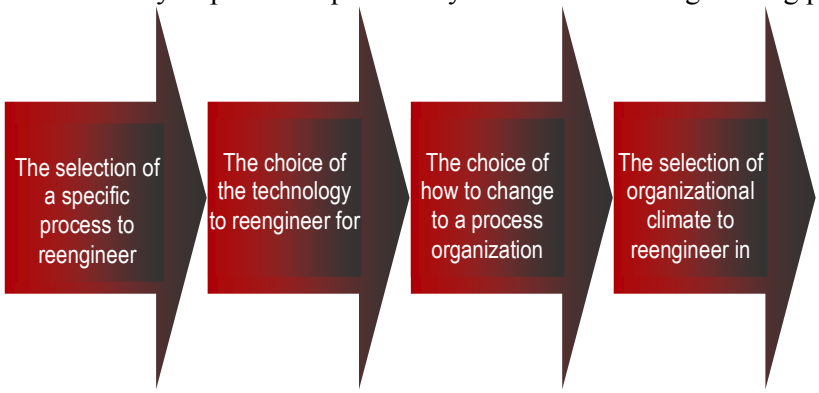

Figure 5. Stages of Reengineering

How should a reengineering project be performed? Once a company has determined that a process needs to be redesigned, it must decide on the correct approach. Unfortunately, few proven and published methods for reengineering are available. The importance of a methodology for obtaining specific objectives is inherent in the many methodologies that have been developed in the information systems arena [e.g., business systems planning, IBM 1975; strategic opportunities, Porter, (1985)]. Many BPR methodologies are very high-level and do not provide detailed guidance. For example, Wilkinson, (1991) provides a simple method: **1.** Determine the desired outcome; **2.** Design processes to produce the outcome, and **3.** Implement the process. As Wilkinson suggests, the difficulty is in the details of each step. Also, generic methods can be made to fit the project (e.g., one could imagine the traditional Systems Development Life Cycle being applied, albeit inappropriately). However, neither method provides specific support for successfully completing a reengineering project. A third option is to hire a consultant. Many consultants are successful at developing and implementing process redesigns. However, this may be expensive and may not be a viable solution for some companies. Using Wilkinson's (1991) model, we can examine the specific support required for each step of a reengineering project. First, determining the desired outcome requires a method to arrive at that determination. The method should provide support for developing an understanding of the external customer's needs or desires for the process, and of the internal customer's point of view. It also is important for the

method to avoid inherently limiting the assessment of a possible outcome. In reengineering, goals must be well beyond current status to be worth the effort. Methods grounded in the present may not develop appropriate outcomes. Some authors, such as Hammer and Champy (1993), recommend benchmarking; looking for the best practices in your industry, and especially in other industries that have processes similar to your own. Are there standards for the generic processes suggested by Davenport (1993)? What are good benchmarks for product development, order fulfilment, etc.? Second, designing processes to produce the desired outcome must rely on methodology that not only ensures successful design, but also encourages thinking "out of the box." Creativity in applying information technology to process redesign may be the key to better designs. Research on creativity has demonstrated that different approaches to a problem can either facilitate or inhibit creativity [Amabile, (1983)]. Hammer and Champy, (1993) suggest a group problem solving approach. However, this does not provide a strong method and, in terms of creativity, it is unclear whether a group is more innovative than a collection of individuals. What are successful methods for assuring creativity in redesigning organizational processes while still producing an effective, implementable process? Finally, implementing the new process may require strong guidelines. Because of the radical nature of reengineering and the dramatic effect it may have on the employees and culture of the organization, reengineering projects may push the bounds of implementation knowledge and skills. Reengineering has drastic effects on employees' jobs. Many times people are displaced, moved, or fired because of the new job requirements. Joshi's Equity-Implementation Model (1991) suggests that this may hinder effective implementation because user's attitudes toward change are colored by their perceptions of the effect of the change on themselves, on how favorably or unfavorably changes are distributed among employees, and on themselves compared to other employees. Without careful planning, the employees' perception of reengineering projects may be a major inhibitor to successful implementation.

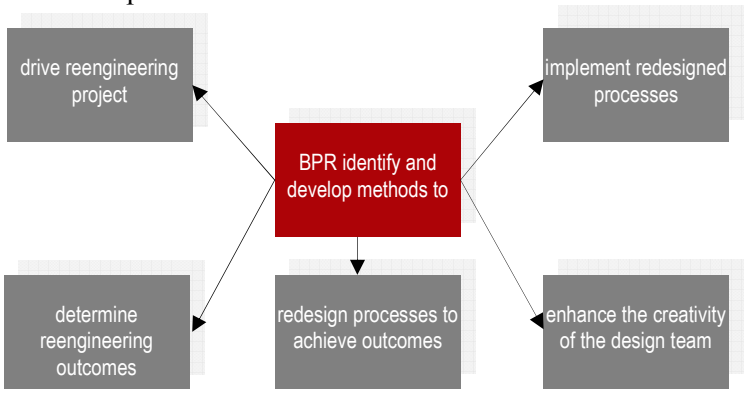

Figure 6. Reengineering Methods

■ **Ensuring of the success of a reengineering project**

The potential importance of reengineering projects on the organization's ability to compete suggests that the organization should take every possible step to ensure the success of the project. However, little is known about the critical success factors for BPR projects. Certainly project ownership and management are important issues. Who has responsibility, and who should lead the project? Who is on the reengineering team? Hammer and Champy (1993) suggest that a senior executive must be in charge of the project to provide resources and credibility to the effort, and that there must be a process owner and a reengineering team consisting of the organization's best and brightest people. To give it proper attention, team members should devote at least half time to the project. Is this the best way to organize reengineering efforts? Additionally, training is likely to be an issue for these teams. What should the training consist of, and who should do it? Should the reengineering effort in an organization be managed through a steering committee? In a study of telecommunications, Torkzadeh and Xia (1992) found that management by a steering committee was more likely to lead to organizational

support and recognition of the function. Other research also suggests that steering committees are essential management structures. However, Hammer and Champy (1993) suggest that a steering committee is optional; some companies have been successful using it and some have been successful not using it. Is a champion important to the effort? Reich and Benbasat (1990) suggest that having a long-term champion for customer-oriented strategic systems is related to the success of the system. Many other researchers also suggest that a champion is often the key to successfully implementing an information technology project [Lockett, (1987); Runge, (1988); Vitale and Ives, (1988)]. These findings suggest that BPR efforts may need someone in the company outside the reengineering team to ensure the success of the project. Considerations other than the organization of the BPR effort are related to the success of BPR projects. Understanding the needs of the users of the process is certainly important. Reich and Benbasat (1990) suggest that awareness of customer (or user) needs is a major factor in the success of customer-oriented strategic systems. However, Davidson (1993) suggests that a company should give the customer (user) what they've never dreamed of, not just what they want. Another interesting complication is the cross-functional nature of most reengineering projects. Does this broad perspective have implications for the factors that require control and coordination in such a project? These issues can have a major impact on the success or failure of a reengineering project. They are extremely important because it is estimated that as many as 70% of all business process reengineering projects fail [Moad, (1993)]. Much knowledge must be gathered on the important success factors for these projects, how these factors can be supported, the most common sources of failure, and how these can be alleviated or avoided.

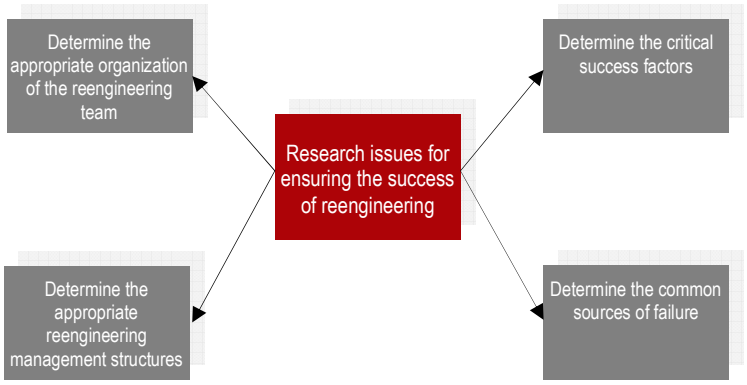

Figure 7. Research issues for ensuring the success of reengineering

■ **The role of information technology and the information systems staff**. Information technology plays a major role in process reengineering due to the way it enables more efficient and effective business process designs. Given the importance of IT to reengineering, how are information technology capabilities mapped to process needs? How are capabilities identified and communicated to the people involved with reengineering? For example, although limited in breadth, the knowledge-based system classification framework developed by Meyer and Curley (1991) could be used lo assess the capabilities of new expert systems shells. Conversely, the application classification could drive the selection of a knowledge-based technology. Emerging information technologies need to be communicated to management and users so they can apply the technologies to their processes or plan to use these technologies as the technology matures. What is the best (or a good) way of describing the business capabilities of information technology? Ein-Dor and Segev (1993) developed technology function definitions to classify information systems. This scheme is relatively thorough, but may or may not be an effective tool for communicating information technology capabilities. Hammer (1990) stated basic principals of reengineering (e.g., put the information-processing work into the real work that produces the information; link parallel activities instead of integrating their results). Can these be used to classify information technologies? How they can be applied? Davenport (1993) suggests some

impacts information technology can have on processes (e.g., automational, informational, sequential, tracking, analytical, geographical, integrative, intellectual, disintermediating). Are these a good foundation for assessing capabilities of information technology? More work needs to be done in developing a language for assessing and communicating the business capabilities of information technology.

What is the **role of the information systems staff in reengineering projects**? Should they lead the way or play a supporting role? What factors dictate their role? If IS staff do not take the lead, how should they be involved? Should they provide systems analysis support, or should they focus primarily on technical support? Certainly one role they could play is to actively support the project's champion.

Beath (1991) suggests that IS can support champions with: **1.** information to help them evaluate technology and persuade others, **2.** technical expertise, and **3.** political support. In addition to the role IS plays in the reengineering effort, the skills of the IS staff may be important to the success of the project. Should the staff have rapid development skills? DBMS skills? Telecommunication skills? Is a third-generation language adequate fur reengineering? Dues the IS staff need training in process evaluation, mapping, and management? The answers to these issues imply that not all organizations can be involved in reengineering.

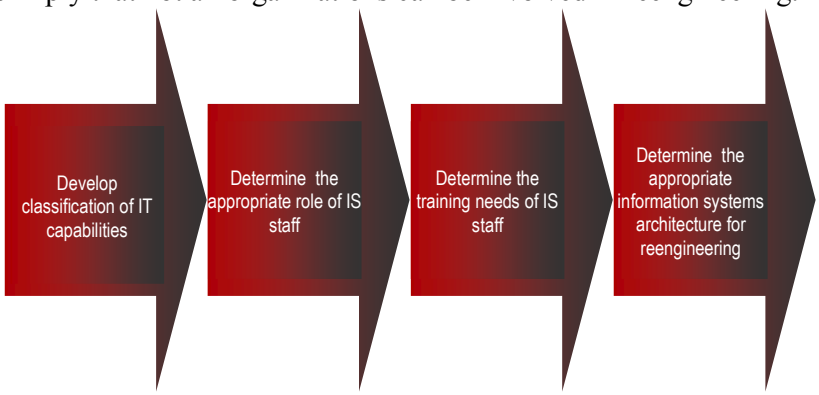

Figure 8. Role of Information Technology

Another issue related to information technology is the **organization's computing architecture**. Allen and Boynton (1991) suggest that the current form of information systems at most large corporations will never meet the "speed and flexibility/ low cost and efficiency" demands of the 1990s. They suggest two alternative architectures: **1.** "low road," where technology and its management are dispersed throughout the organization, and **2.** "high road," where technology and its management are highly centralized in the organization. Are either of these architectures effective for reengineering? If not, what type of architecture is effective? Will a mainframe architecture support all required activities? Will a network architecture? Client/Server? The cross-functional nature of business process reengineering suggests that a stand-alone PC architecture would not be adequate. Does architecture depend on the process to be redesigned? These issues imply that an organization may need to restructure its computing resources before implementing reengineered processes.

■ **How will reengineering affect the relationship between business and society?** Classic studies in MIS deal with the impact of computers on society [Attewell and Rule, (1984)]. Most concluded that computers had both positive and negative effects and the impact of computers on middle management is a function of how centralized decision making is in the organization. If decision making is centralized, computers can be substituted for the communication and information processing done by middle managers. However, if decision making is decentralized, computers may not be substituted as easily for middle managers because the managers serve not only as information processors, but also as decision makers, and their ranks may increase. But what of reengineering? Successful efforts often lead to a massive reduction in the need for employees. This is not substituting technology for humans in information processing tasks, but

eliminating those tasks altogether. What of the individuals that lose jobs to redesigned processes? This does not appear to be a desirable outcome for society. On the other hand, the loss of a few jobs may allow the company to continue to be competitive and provide some level of employment for society. Of even greater significance is if reengineering throughout the country is leading to fewer jobs, what is society going to do with so many displaced workers? Much IS literature suggests that computer technology does both deskilling jobs and enhancing jobs [Attewell and Rule, (1984)].

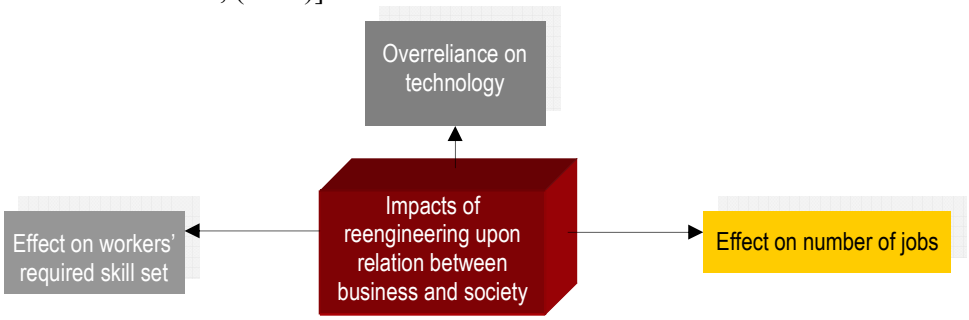

Figure 9. Research issue regarding impacts of reengineering upon relation between business and society

Do redesigned processes lead to better jobs or to worse jobs? Much of the reengineering literature suggests that jobs are enhanced. Technology enables new process designs which empower employees [Hammer and Champy, (1993); Davenport, (1993)]. However, if the jobs are better, demanding a high skill set, who ensures that all potential workers get the education they need to move into these positions? Should reengineering focus on new processes which offer greater worker satisfaction? How is this done? Also, what of the overreliance on technology? Complex processes are inherently harder to control than simple processes. Many IS organizations find it very difficult to maintain the current systems used to run the organization. The potential for disasters if the technology is out of control or fails adds another layer of complexity that would be as difficult, or more difficult, to deal with.

5.2. The Price of Experience

Why are so many companies still eager to experiment with reengineering, even when they have experienced previous failures themselves? Companies such as American Express and Amoco were able to learn from earlier reengineering failures, and succeed on later attempts. It seems that "experience, more than the possession of the right approach or methodology, is the key to reengineering triumph." This acknowledgement may help explain the increasing interest in reengineering, despite the high failure rate.

Wheatley, on the other hand, describes the appeal of reengineering as a sign of "collective desperation." She notes "when a star is in its death stage, about to collapse on itself, it burns at its brightest, with tremendous energy and fury.

Reengineering is the supernova of our old approaches to organizational change, the last gasp of efforts that have consistently failed." [Brown, (1994)].

5.3. The Role of the Leader and the Manager

Many articles point that BPR must have the full support of top management to succeed. If resistance is encountered, the leader must be willing to "drive" change, even to the point of ruthlessness. One article exhorts the leader to emulate a private detective -- such as Philip Marlowe – who adheres to the following "heroic" qualities; Relentless adherence to what is right; Courage – moral as well as physical; Recognition that surface appearance is often an illusion; A dogged determination to get at the deeper truth [Furey, Garlitz, and Kelleher, (1993)]. Managers in a company undergoing reorganization must work to quell the fears of employees and resistance to change (despite the fact that they may have their own apprehensions).

According to one executive with BPR experience, "Once the [reengineering] plan is in place, you've got to pull out the stops and execute it. You cannot live in limbo between what you

used to do and what you're going to do." Otherwise, the dramatic results are sacrificed, people lose their focus, and "reengineering slips into process improvement." Employees may be enthusiastic about reengineering during the initial phases if they view it as a "win- win" situation. Some companies experience resistance in later stages when employees begin to harbor doubts about the impact of reengineering, and managers are forced to adopt a more "insistent" policy.

CSC Index points to poverty of ambition as a reason why BPR projects fail. "Companies that just flirt with [reengineering] suffer the pains without the gains". Reengineering advocates urge management to pull out all the stops and implement change on a grand scale. Managers in the organizations after reengineering are compared to coaches. They do not order; they guide. They do not direct the work of others; they coordinate, facilitate and empower.

5.4. Reengineering the Human Resource

Hammer and Champy recognize the importance of the human resource when they state "companies are not asset portfolios, but people working together to invent, sell and provide service." [Ettorre, (1995)]. However, they fail to demonstrate how to reengineer the human resource in conjunction with reengineering processes. Of the four cases presented in Reengineering the Corporation, only the case of Capital Holding addresses this area. Capital Holding performed a "cultural audit" which revealed that the unwritten code of conduct encouraged information hoarding and barely acknowledged the customer. In order to combat these tendencies, senior management provided a constant flow of information throughout the company regarding reengineering expectations and successes, and revised the performance appraisal system to emphasize the new values of team work and cooperation.

Although Hammer and Champy provide a long list of why reengineering fails, nowhere do they include the prerequisite that no reengineering effort will succeed without first reeducating and retraining the people who will ultimately work with the new process. According to Meg Wheatley, "If you're going to move information and responsibility down to the local level, then the key question is how can you be sure that people will behave appropriately? You need to make sure that everyone is playing by the same rule book." [Brown, (1994)].

CSC Index identifies two principle obstacles to BPR are fear among employees that their jobs are endangered and that years of experience will account for nothing. To overcome these apprehensions, managers must constantly communicate their plans and expectations.

Although companies which are seeking to reengineer may work on revamping the performance appraisal system to support new values, this can be problematic. When bonuses are linked to profits or even the performance of a team, this may lead to a situation where the individual is judged on factors beyond his or her control.

5.5. Human Reengineering Case Study: The Conquering Power of the Small

These gestures consisted of creating an atmosphere of trust and optimism among GTO's harassed employees; by listening to and adopting their suggestions, improving their health and disability insurance, and when things started to turn around, increasing their pay and distributing bonuses from a profit sharing plan. The salesman were put on salary with incentives. Acts such as fixing the leaky roof, allowing ten minute breaks, and keeping the coffee machine stocked convinced the employees that that Mitchell was "genuine." The following year, GTO witnessed a cultural and company turnaround. Net profits moved from being in the red to nearly $500,000. This was accomplished by a 9% increase in gross sales along with a 33% decrease in total operating and administrative costs. Employee turnover decreased equally dramatically. As employees began to seek outside education and were promoted from within, the number of returned goods fell [Hamel and Prahalad, (1994)].

GTO's dramatic turnaround was a result of many small steps which could be said to foster precisely the "culture of incrementalism" that Hammer and Champy warn against. The focus was on human resources rather than on processes.

5.6. BPR Places the Customer at the Center by Breaking Down Organizational Barriers

Service organizations can put their professed commitment to customer satisfaction into action by placing the customer at the center of the reengineering process. Service workers are often unable to satisfy the customer because they must follow strictly defined rules, and they lack the authority to make exceptions or the resources to complete a transaction.

Robert Janson points to three basic principles that provide the foundation for service organizations seeking to reengineer:

- Make the customer the starting point for change – by identifying customer wants and creating the infrastructure to support these expectations;
- Design work processes in light of organizational goals;
- Restructure to support front-line performance [Hyatt, (1995)].

When IBM started reengineering in 1992, the guiding principle was to become more customer-centered. Twelve customer relationship processes were identified and used as a basis for the reengineering project. One example is "solutions delivery": a contract between IBM and the customer for a complete IT system, including hardware, software, technical support, consulting services and third party products. The redesigned process moved the responsibility for pricing to the case team, who used "pricing tool" software. This eliminated a nearly two month delay that formerly occurred when pricing was referred to IBM headquarters [Janson, (1992)].

5.7. The role of Information Technology

According to a roundtable of executives with extensive BPR experience, although information technology plays a central role in reengineering, "the IS organization in many companies is unable to play." This ineffectualness may be due to the historic inability of IS to do "anything big quickly", the "breeding out" of risk-taking, or the lack of advanced technology groups.

Another danger is that, since the IT group is not perceived as being part of the business process, they are excluded from the reengineering team. Aetna tried to combat this "disengagement" by presenting workshops on the clients business to the IT group. Senior management may be skeptical about the effectiveness of IT as a whole due to the "lackluster" performance of many information systems in the past decades. In fact, it can be argued that the huge investment in IT has had little impact on productivity. Although 85% of IT spending in the 1980's was in the service sector, productivity in this sector increased only 1.9%, while productivity in the manufacturing sector rose 44% [Kehoe, (1994)]. Based on this record, it is not unreasonable to view IT as a disabler, which is never used to "challenge why things are done in a company, but instead justify the way they are done." Systems in the service sector have been used to generate more unneeded reports, speed up superfluous work steps, generate unnecessary information, encourage shoddy thinking and misdirect attention to spurious details [Kehoe, (1994)].

One (anonymous) company failed repeatedly to reengineer because it "spent a lot of time building castles in the air regarding process redesign without paying attention to information technology." On the other hand, Ontario Hydro found that the greatest improvement came when they gave the IT group "the tools, the information, and the authority" to implement change, rather than by core process reengineering. The IT group was able to implement client server applications relatively early – because individuals took "ownership, responsibility and accountability without [the company] even asking for it."

Most analysts view reengineering and information technology as irrevocably linked. Walmart, for example, would not have been able to reengineer the processes used to procures and distribute mass-market retail goods without IT. Ford was able to decrease its headcount in the procurement department by 75% by using IT in conjunction with BPR, in another well known example.

Despite studies that indicate over half of all reengineering efforts are initiated "because of a perceived information technology opportunity...the actual technological solution is far less important than educating employees to use IT as both a strategic initiative and as a tool in the reengineering process."

Based on the above findings, some insist that when developing a reengineering strategy, the best companies "ignore information technology." Only after the strategy is complete should innovative IT applications be benchmarked, since innovative applications often "stem from a combination of breakthrough ideas and from modifying several best practices." [Davenport, (1995)].

IT can prove useful in the reengineering analysis and design process. Graphics software and CASE tools can produce process maps; spreadsheets and costing software allow for activity-based cost analysis; databases can track customer satisfaction and complaints; "blind" e- mail bulletin boards can be used to capture employee suggestions. In addition e-mail and groupware can facilitate communication and coordination across geographical and organizational barriers [Davenport, (1995)].

During the implementation stage, companies should follow these basic rules

- Recognize that IT is only part of the solution: It allows managers to collect, store, analyze, and communicate and distribute information better.
- Cut and paste the IT tools needed.
- Bring in internal or external IT experts: their knowledge, skills, acumen, and experience are invaluable.
- After implementation, continually monitor IT performance and keep up with new IT developments [Davenport, (1995)].

On the other hand, some companies have found it useful to design a technology strategy before reengineering. When Star Maker Inc., an entertainment/communications company experienced a downturn, the CIO of the company convinced senior management to make addressing the role of IT the first item on the agenda. Star Maker designed a plan to use technology to place the company in the forefront of the industry, with services such as electronic product catalogues, customer interface standards, sophisticated electronic data links, customer and market databases, and digital video. The new technology needed to drive growth was then paid for by the cost savings from BPR.

Davenport proposes an "ecological" model when redesigning information systems. Up to the present, the dominant model of IT has been "that data streams can be deigned architecturally and engineered...[This] approach involves detailed modelling of information requirements and flows, and their relation to business activities and processes." The traditional approach runs into difficulties when confronting environments that are fluid, dynamic, or characterized by dissent. Davenport argues that the basis of IT redesign must be the individual who uses the information. Data turns into information when it is placed in a human, behavioral context.

Wheatley also expresses misgivings about the dominant scientific model for IT. She suggests that the natural sciences may be a more appropriate model. She describes organizations as "living systems" which, in order to be healthy, need "access to its own intelligence ... where conditions support the use of that intelligence." She points to the example of the U.S. Army, which is "intent on moving information everywhere in their organizations without knowing ahead of time who will need what." [Brown, (1994)].

The "democratization" of IT from the mainframe to the PC is "breaking down the communications barriers between corporate functions, suppliers, and even customers." [Davenport, (1995)] Hammer and Champy call this the "disruptive" power of IT. This ability for information to be at many places at the same time – which allows companies to reap the benefits of both centralization and decentralization – is at the heart of BPR.

5.8. Alternatives to BPR

Reengineering works with existing business practices. This "impairs the entire reengineering process, as it stifles innovation in finding new ways to compete." BPR falls short when dealing with new products or services, since "any strategic objectives achieved are simply the by- product of improved productivity." [Kehoe, (1994)].

Strategic reengineering addresses this shortcoming by focusing on designing the organization to compete. This is accomplished by undertaking strategic initiatives at the start of the reengineering process. These initiatives seek to provide understanding of the markets, competitors, and the position of the organization within the industry. Critical success factors required to compete are identified and prioritized. Only then, are individual business processes addressed [Kehoe, (1994)].

Participative business makeovers reject the "top- down" approach to reengineering in favor of a middle ground, where the managers and workers come together to redesign business processes. Davenport proposes that the BPR team be split into two parts, a design team made up of senior mangers, and an execution team composed of people who will actually do the work. While Hammer and Champy specifically warn against spending too much time studying the current process, this method advocates an "ethnographic" approach where the designer studies and participates in the process to be redesigned. This provides a deeper understanding of the process and demonstrates the team's commitment to the workers. The team must be willing to sell a new process as though it were a process, expect and tolerate modifications to the process, and change the reward system to motivate change.

Critics of BPR argue that it is often used as a euphemism for "denominator reduction." One may view productivity as a function of revenue or sales divided by the number of people required to generate the revenue. BPR increases productivity by cutting costs but does nothing to increase the revenues or sales. BPR is often undertaken by firms "playing catch up" to avoid disaster, but it does nothing to "regenerate core strategies," which can lead to a real growth in revenues [Ettorre, (1995)]. For example Britain's manufacturing output (the numerator) increased about ten percent between 1969 and 1991, while the number of employees (the denominator) was cut in half. Although productivity skyrocketed, Britain surrendered global market share.

Other critics warn that although BPR may lead to a competitive advantage, it is destined to be very short- lived. When one company lowers its costs of doing business, other companies will immediately follow, and the competitive advantage is lost. One writer warns that the reason why reengineers are so dangerous is that, due to the obsession with bench-marking, "all firms in an industry start converging on a point of no difference and thus of no profit." [Kavanagh and Chellenge, (1993)].

During the past decades the U.S., along with the rest of the world, has had to reassess the idea of competitive advantage. The idea that competitive advantage lies in a nation's natural resources has been abandoned. BPR, if left unchecked, seems to offer the dismal prospect that competitive advantage lies in constant cost minimization. The steering committee agrees with Robert Reich and others who propose that competitive advantage for the next century lies in a nation's workforce and infrastructure of a nation, and the ability to create and deliver new products and services in the global marketplace.

■ Eliminating the ill effects of Business-Process-Reengineering

Business Process Reengineering (BPR) has always neglected the human aspect of an organization concentrating only on business process and technology in order to enhance productivity. Koenig and Srikantaiah (n.d.) mentioned that the negative side of BPR is downsizing, which has a negative impact on the employees. Good communication and extensive knowledge sharing are not likely to happen unless there is an atmosphere of trust and some commitment to the employee (Koenig and Srikantaiah, n.d.). From the perspective of KM the employees are supposed to be the integral part of the intellectual asset of an organization (Srikantaiah, n.d.). Koenig and Srikantaiah (n.d.) stated that trust is one of most important social

capital within an organization. The prevailing view of BPR that employees are treated as commodities hampers both the intellectual assets, or the intellectual capital (employees) and their social capital (trust of the employee), which are the integral part of a KM. In fact Koenig and Srikantaiah termed reengineering as the enemy of knowledge.

6. Conclusion and Future Research

The motivation of this paper is to draw attention to important issues of technology in capturing, codifying and disseminating knowledge throughout the organisations. It reflects the need to store not just different forms of knowledge, but different types of knowledge. However, it should be remembered that an overemphasis on technology might force an organisation to concentrate on knowledge storage, rather than knowledge flow. New insights and opportunities are available to organisations if they are able to integrate knowledge across shared and different contexts.

The Internet has enabled the creation of virtual communities, networked through technologies only available just a few years ago. As the Internet is becoming the standard form of collaboration between organisations, the trend of the e-knowledge network looks set to continue. While technology can greatly enhance an organisation's knowledge management strategy, it does not necessarily ensure an organisation is managing its resources and capabilities in the right way. However, technology is vital to enable the capturing, indexing, storing and distribution of knowledge across and with other organisations. Knowledge can be viewed in a number of other contexts, it is vital each is addressed if an organisation is to improve performance.

- Successful knowledge strategies depend on whether organisations can link their business strategy to their knowledge requirements. This articulation is vital to allocating resources and capabilities for explicating and leveraging knowledge.
- The competitive value of knowledge must be addressed to assess areas of weakness. Strategic efforts should be made to close these knowledge gaps to ensure the organisation remains competitive. The strategic value of knowledge should be addressed, focusing on the uniqueness of knowledge.
- Finally, an organisation should address the social aspects affecting knowledge initiatives, namely cultural, political and reward systems. Beyond the management roles proposed in the paper, the environment should promote co-operation, innovation and learning for those partaking in knowledge based roles.

Knowledge is more than a fad, it is now at the centre of an organisation's strategic thinking. The essence of any knowledge management strategy can be summed up by the following quote, from Drucker [Drucker, (1993)]: "*A company's key to success resides not so much in it's work and capital as in the capacity to treat knowledge, corporate knowledge, be it explicit or tacit."*

Perhaps the most important differentiator between the three views of change in KM we have analyzed here is the methodology used to analyze change in the three instances. Basically, Koenig and Snowden take a story-telling approach to analyzing changes in the KM evolutionary process, whereas McElroy bases his case for fundamental change on the KLC knowledge processing framework and the distinction between knowledge processing and KM.

Koenig takes an IT approach to KM and basically tells *a story* of changes in IT-related concerns. Thus, he starts by noting that the first stage of KM was about using the Internet for knowledge sharing and transfer. The second stage was a reaction to the failure of the first to live up to its promise by failing to take account of human factors essential to make IT applications successful, and the third stage is about improving the IT side by making it easier for humans to navigate to the information or knowledge they want or need.

This story of changes occurring in response to a desire to make IT-based KM solutions successful does not specify a conceptual framework based on concepts of knowledge, KM, business processing and outcomes. Lacking such a framework, Koenig has no tool to compare

the three stages of KM in order to evaluate the comprehensiveness of change in its key elements. That is why his analysis seems ad hoc and questionable from the standpoint of whether the changes he records are really so fundamental as to suggest new stages in the KM evolutionary process.

The situation is little better with Snowden's approach. Boiled down to its essentials, he almost seems to be saying:

- The first age was about applying the BPR notions of Hammer and Champy (1993) on a foundation of Taylor (1912);
- The second age was about applying the vision expressed in Nonaka and Takeuchi (1995); and
- The coming third age will be about applying the vision expressed in his own Cynefin model, coupled with Stacey's So, Snowden's story of change is not guided by a transcendent conceptual framework that can provide us with categories to set a context for describing change, but rather is a claim that KM proceeds from vision to vision expressed in great books and/or articles. His view provides no guide about what the next fundamental change in KM will bring, because how can we know what the rest of a story might be?

McElroy's (1999) approach to change uses the conceptual framework of the Knowledge Life Cycle (KLC) to analyze the change in KM that he believes suggests there have been two and only two generations so far. The KLC framework clearly distinguishes knowledge production and knowledge integration processes as the two processes comprising knowledge processing behavior. In turn, these fundamental processes are divided into four sub-processes for each process. Knowledge processing activities are clustered in either the knowledge production or knowledge integration categories, and that KM initiatives have also primarily been concerned with either one or the other. Once that recognition was made, it was easy to see that the early period of formal KM, from the early 90s to at least 1999, has primarily been about knowledge integration, and that SGKM, the *fusion* of concern about knowledge integration with knowledge production, begins only in the late '90s and is first explicitly formulated against the backdrop of the Knowledge Management Consortium International KMCI, including the authors' prior works: Firestone (1998, 1999, 1999a, 2000) and in McElroy's (1999) article. The SGKM "paradigm" of fusion between supply- and demand-side KM now exists alongside the continuing practice of supply-side KM, which is still dominant in the field. But the growing concern with innovation in corporate, government, and intellectual capital circles suggests that further fundamental change in KM is unlikely until there is a much wider embrace of demand-side problems. If, however, fundamental change were to occur, the KLC framework suggests that it will revolve around a reconceptualization of knowledge processing, involving a specification of some new fundamental process in addition to knowledge production and integration, or perhaps a fundamental re-conceptualization of knowledge production or knowledge integration processes. The fact that neither the Koenig nor Snowden views of change focus on such an evolution in how we see knowledge processing explains why the changes they focus on do not add up to a new stage, age, or generation of KM.

Business Process Reengineering provides an opportunity for information technology to have the impact on business productivity that many IS academics and professionals have long suggested that it should have. Radical redesign through information technology enables processes vastly improved in both effectiveness and efficiency. Organizations that are effective at reengineering and view it as a periodic effort will lead in competitiveness in the future. For reengineering through information technology to become a legitimate business tool in the portfolio of general managers, there must be a high probability of success. However, the rate of failure of reengineering projects has been estimated as high as 70% of all projects begun, and the failure of BPR is beginning to be discussed prominently in leading business periodicals. Why do these projects fail? Hammer and Champy (1993) suggest that BPR projects fail because people do not follow the rules. Experts and many other new technologies stress that the two main criteria for success in implementing their respective technologies are: **1.** high level of

management involvement, and **2.** education of personnel. Perhaps, to increase the probability of success, we need to add two other criteria for BPR: **3.** a reengineering team consisting of the best individuals in the organization, and **4.** a reengineering champion that is external to the reengineering teal. Essentially, the question of success or failure in a reengineering project becomes: Does the methodology breed success or does the quality and commitment of the personnel involved? The issues are complex and need further research; however, the authors conjecture that people are more important than methodology and the four criteria described above are likely to be the primary determinants of BPR success. Business process reengineering also brings certain societal questions to a focal point. Less highly skilled people and the associated high paying jobs are going to be needed as technology continues to improve and processes are redesigned to take advantage of this technology. The global economy may not be able to replace those jobs, leading to a society of two classes, the rich and the poor. As this occurs, our approach to working, taxes, and living may need reengineering – a radical redesign of the process of employment, rewards, and leisure time.

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