ABSTRACT

Technology is providing the link to connect people across inseparable boundaries. Wireless technologies are promising cost-effective, efficient and reliable processes. Firms are restructuring and investing in opportunities like remote office concepts. Technology vendors across the value chain from design, manufacturing, and business planning are developing connectivity between different technologies. The benefits of connectivity are promised to yield improvements in faster and more reliable information flow thereby giving competitive advantages as firms can react faster than competitors. Technological connectivity is promising links from customers to suppliers giving additional benefits in shorter time to market. In this paper the benefits, rewards and risks of technology connectivity is explored. In addition useful lessons for managers are presented.

1. INTRODUCTION

Siriram (2003) provides a cyclic model of the firm. Arguing from a resource based view (RBV) and transaction cost economic view (TCE) a cyclic model for technology and business connectivity is provided. Before moving onto the cyclic model the terminology associated with transaction processes and governance structures needs to be defined. Siriram and Snaddon (2003a) provides the following definitions:

- “Transaction processes occur through the transformation process as firms exchange goods and services. Transaction processes may be necessary to build criteria like cost, quality, speed, dependability and flexibility. Transaction processes are either cost reducing or value adding, Williamson (1981) characterizes transaction processes to include attributes like transactional certainty, frequency, durability and transaction specific interests.”

- “Williamson (1981) defines governance structures as the explicit or implicit contractual framework within which transactions occur (markets, firms, and mixed modes, for example franchising). We understand this to encompass the tasks of administration, direction, or management of information flow through the organization by making decisions, suggestions, orders, etc. In other words providing the necessary leadership for the business.”

Having defined transaction processes and governance structures, the cyclic model is next discussed. Figure 1 shows the model described by Siriram (2003). The model may be described as follows:

- The competitive environment [1.1] consists of competitors and external factors. As a result, of these competitors and external factors firms are forced to react and improve competitive advantage. Competitors introduce newer technologies thereby creating competitive advantage to which other firms have to react. External factors like globalisation, e-business etc, place further pressure on firms to react in order to sustain and improve competitive advantage.

- As a result, of the competitive environment [1.1] firms develop business strategies. Business strategies are developed so firms can cope with the competitive environment and sustain and improve competitive advantages.

- For effective business strategy, firms need organizational determinants [1.3]. Siriram and Snaddon (2003b) describe organizational determinants to include individuals, assets and organizational structures.

- For successful business strategies technology management [1.4] is required. Technology management includes technologies, technological resource skills and firm competencies. Technology management
[1.4] also requires the correct organizational determinants [1.3]. Technology management then creates the platform for manufacturing mix processes.

- Manufacturing mix processes [1.5] is then said to lead to improvements in manufacturing mix criteria, i.e. cost, quality, speed, dependability and flexibility.
- Through technology management [1.4] and manufacturing mix processes [1.5], benefits in transaction processes [1.6] and governance structures [1.7] are obtained.
- Through transaction process [1.6], governance structures [1.7] are necessary. Governance structures include technological sourcing, knowledge management, organizational learning and relationship management.

2. TECHNOLOGICAL HIERARCHICAL SYSTEMS

Having introduced a cyclic model as shown in Figure 1, the cyclic model may be used to introduce technology and business connectivity. In a changing competitive environment, managers are forced to adopt newer technologies, systems and processes to sustain and improve competitive advantage. Managers are faced with linking different technological systems.

![Figure 1: A Cyclic Model, adapted from Siriram (2003)](image)
Siriram and Snaddon (2003a) show the relationship between systems and technologies. Systems exist from non-assembled products to open systems that link to control devices and ERP management systems respectively.

Arguing from an open systems perspective, ERP systems are necessary to link customers and suppliers, front-end and back-end systems ranging from customer relationship management (CRM) to supplier relationship management (SRM) are being provided by technology vendors. Technology vendors argue that these front-end and back-end systems create opportunities for information flow between customers and suppliers and thereby improve information flow and data reliability. These technologies create opportunities for firms to integrate horizontally. Using such technologies firms weigh the benefits of horizontal and vertical integration as they opt for outsourcing of non-core activities.

3. BUSINESS INTEGRATION

Siriram (2003) quotes Williamson (1981) arguing transactions will be carried out in markets unless market exchange results in high transaction costs, in which case transactions will revert to being within firms. In addition, they argue economies of scale arise from growth within the same function called ‘horizontal integration’ and / or by incorporating other functions called ‘vertical integration’. Using technologies opportunities for forward integration and internal organization may also be explored. As firms opt for transacting with other firms, be it forward or back integration networks with other firms develop.

Technologies are used to create channels for information flow between firms in the network structure. Some technology providers have developed standalone systems to integrate firms horizontally. For example (Siemens information systems limited) SISL have developed business connect solutions linking suppliers, distributors and services. They define these linkages as the extended enterprise. Through electronic connectivity benefits in improved information flow, between firms with their extended partners may be realised. Typical service offerings in the SISL model include online processing of order confirmation, daily updated information on outstanding payments, online allocation of orders against available stocks, according to assigned location priorities and stock availability, meeting the peak season demand with better planning and coordination across the value chain, etc. As can be seen, merits from technological connectivity can be achieved. However technologies alone do not create competitive advantages, it is through relationships with the network that also lead to competitive advantage. As technologies and relationships with firms develop, networks are reshaped to create competitive advantages for firms in the network structure.
4. NETWORKS IN TRANSITION

As firms position themselves in the value chain, networks with other firms develop. Siriram and Snaddon (2003a) refer to Madhavan et al (1998), they say being well connected and a significant player in a network can be a crucial strategic advantage as each contact is a potential conduit for relevant information, resources or influence. Firms either position themselves centrally in a network or more peripherally. The position of a firm in a network structure is key to competitive advantage. Firms centrally situated in a network structure possess opportunities to partner with other firms, that are competitive and thereby higher payoffs are likely. Firms lower down the network structure offer lower value added services and hence receive lower payoffs. Therefore firms, are in a continual race against each other to improve their position in a network structure. Madhavan et al (1998) speak of structural reinforcing or structural loosening events. Firms more central in a network structure create structural-reinforcing events that will sustain or improve their position in a network structure while firms more peripheral in a network structure will create structural-loosening events that will create opportunities for them to reposition themselves more centrally in a network structure.

Many opportunities exist for firms to reposition themselves in a network structure. For example newer technologies like the business connect solution allows firms to link with other firms. These links require investment from both partners in creating electronic links. This joint-investment enables firms to exist in a mutually beneficial relationship that will support the investment made in terms of technology. Through this type of relationship management with respect to closeness, communications, trust and good-will may develop. On the other hand, firms may not develop asset specific solutions in terms of technology with other firms unless a relationship of closeness, communications and trust have existed before. Firms peripheral in the network structure will continually adopt newer technologies that will allow them to penetrate the network structure whereas firms more central in the network structure will also continue to maintain or improve their position in a network structure. These structural-reinforcing and structural-loosening events create opportunities for push and pull technologies. This push and pull relationship creates further opportunities for enterprise reengineering.
5. ENTERPRISE ENGINEERING

Enterprise engineering continues to focus on the challenges of change, integrated change processes, strategic visioning, business process reengineering, continuous process improvement, information engineering, reengineering the IT function and readiness assessment. Enterprise engineering may create opportunities for partnering with customers and suppliers. However, enterprise reengineering needs to take a structured approach. Figure 4 shows the steps involved in an enterprise engineering programme.

Most people implementing technologies expect technological solutions to be the answer to their existing concerns or problems in the way the enterprise functions. Technological solutions alone cannot be the solution, what is also imperative is that managers implementing technologies should be aware of the complexities involved in technological integration, some of these complexities are:

- The steps of simplifying, systemizing, automating, reengineering and further innovation or automation. This process is a continuous cycle as technologies evolve, firms should re-look at their processes and systems to ensure that they are capable to create or sustain competitive advantage.

- The multi vendor problem. Often managers are faced with linking technologies from different vendors. This creates potential problems for interfacing therefore defining the scope and services from each vendor is imperative for successful implementation. Often scope and services required from vendors is poorly defined and firms often end up with half working solutions or exceeding the initial investment required.

- Training of the users is imperative and in addition involving users in scope definition and user functionalities assists in eliminating problems later in the implementation.

- Testing and debugging prior to switch on date also assists in resolving embarrassing problems later on in the implementation.

- Often managers implementing technologies are not the same managers that are responsible for the operation of the technology. Hence, those managers implementing technologies are often criticised for the cost of the investment, the solutions provided, training requirements, functionality etc. Therefore, managers implementing technologies should communicate regularly, clearly specify the cost, benefits, rewards and risks.

- How to ensure sustainability is also crucial to further technology implementations and set a tone within the firm for future implementations.
Having considered factors in enterprise engineering managers should also be aware of the potential costs, benefits and risks in technological implementations. The list above is by no means comprehensive but gives managers an idea of what they should be looking for in technological implementations. In addition, there are also benefits associated with information flow, knowledge transfer, relationship management and organizational learning. Some of these benefits are discussed next:

- As a result of technological connectivity, information flows faster through the firm. Hence individuals, have access to information more frequently and timeously. Therefore individuals can react faster to market demands. Being able to react faster than competitors allows firms to become more competitive than competitors.

- However having information available timeously is not the only criteria for competitive advantage. Being able to access information, synthesise information and make decisions is what creates competitive advantage. Making the leap from information flow to knowledge transfer is the link to relationship management and organizational learning.

- Through information flow and knowledge transfer firms can create the platform for relationship management and organizational learning. Technological connectivity allows sections of firms to interact more frequently. This interaction may force closer relationships within the firm and between firms.

- Through close relationships, organizational learning develops as the firm moves closer to developing an absorptive capacity. Cohen and Levinthal (1989, 1990) define absorptive capacity as a firm’s ability to recognise the value of new external knowledge, assimilate it and apply this knowledge to commercial ends.

### 6. CHALLENGES FACING ORGANISATIONS

Changing technologies are creating:

- Pervasive, powerful intelligent devices,
- Automated factories
- Client servers and right sizing
- Co-operative processing-groupware
- E-business
- High band width open networks
- Multi media image and voice
- User oriented information systems
- Rapid software development

Having amidst these technological changes managers must realise that technological strategy follows business strategy. Often managers become engrossed in newer and emerging technologies and forget that technology is merely a tool for the firm to develop competitive advantages. Managers have to evolve their businesses in competitive environment in which there are many challenges. Some of the challenges are:

- Shorter windows of opportunity
- Fast redesign of products
- Extended enterprise (wireless technologies)
- Participative management
- Entrepreneurship
As technology grows in power it increasingly has the capability to change how the enterprise should function.

Automate existing systems

Redesign business procedures/transaction processes

Re-engineer value systems within and between firms

Rethink firm scope and long-term positioning

**Figure 5: Technology Impacts On Firm Structures, Siriram (2003)**

Having explored some of the challenges facing organisations, it is important to note that in a changing technological environment it is important to ensure sustainability in people, processes and systems. It is only through ensuring sustainability that firms can ensure a place in a global market place. In Figure 5 Siriram (2003) proposes a model for technology impacts on firms. Figure 5 shows as firms grow through a reengineering process newer technologies are developed. Firms need to be aware of those newer technologies as they provide further competitive advantages. However knowing when to invest is also critical to competitive advantage.

### 7. CONCLUSION

Having discussed the changing technological environment and how firms can adapt or sustain competitively in this volatile environment some important lessons for managers involved in technological implementations are next provided.

- Technological strategy follows business strategy.
- Technology is merely a tool to achieve competitive advantage.
- Clearly, define scope and objectives when implementing newer technologies. This helps understand or ring fence the costs, benefits and risks associated with technological implementations.
- Ensure sustainability through people, processes and systems.
- Training, communication, testing and networking with users and technology vendors is crucial.
- Technology gives you the opportunity to integrate information, create knowledge, improve relationship management thereby creating a learning organisation leading to competitive advantages.
- Many technology strategies exist for technology implementers from innovators, early adopters, early majority and late majority. Siriram (2003), Carr (2003), Gardner and Ash (2003) provide research evidence indicating a wait and see stance provides the best advantage.

In this paper, some of the benefits from technological implementations were highlighted. It must also be noted that technology and processes are linked. Managers must take care not to merely invest in tangible technologies to obtain competitive advantages. The match between tangible technologies and intangible...
technologies is crucial to competitive advantage, after all technology is available to the competition as well. It is how one manages, and implements technology that creates competitive advantage.

8. REFERENCES


Siriram, R and Snaddon, DR (2003b) verifying links in technology management, transaction processes and governance structures, Technovation, TECH 1021, Article in Press.


9. ABOUT THE AUTHOR

Dr Raj Siriram is Divisional Managing Director at Siemens South Africa. He is responsible for supply chain management, project management, performance management and business engineering. His research interests are in technology and operations management. Raj has wide industrial experience ranging from industrial and production engineering to manufacturing, operations and project management. Raj is a registered Professional Technologist in engineering. He holds a PhD in Industrial Engineering from the University of Witwatersrand, in South Africa, School of Mechanical, Industrial and Aeronautical Engineering.

CONTACT

eMail raj.siriram@siemens.com
Website www.siemens.co.za
Telephone +27 (0)11 652 2768
Fax +27 (0)11 652 2989