



ACT II

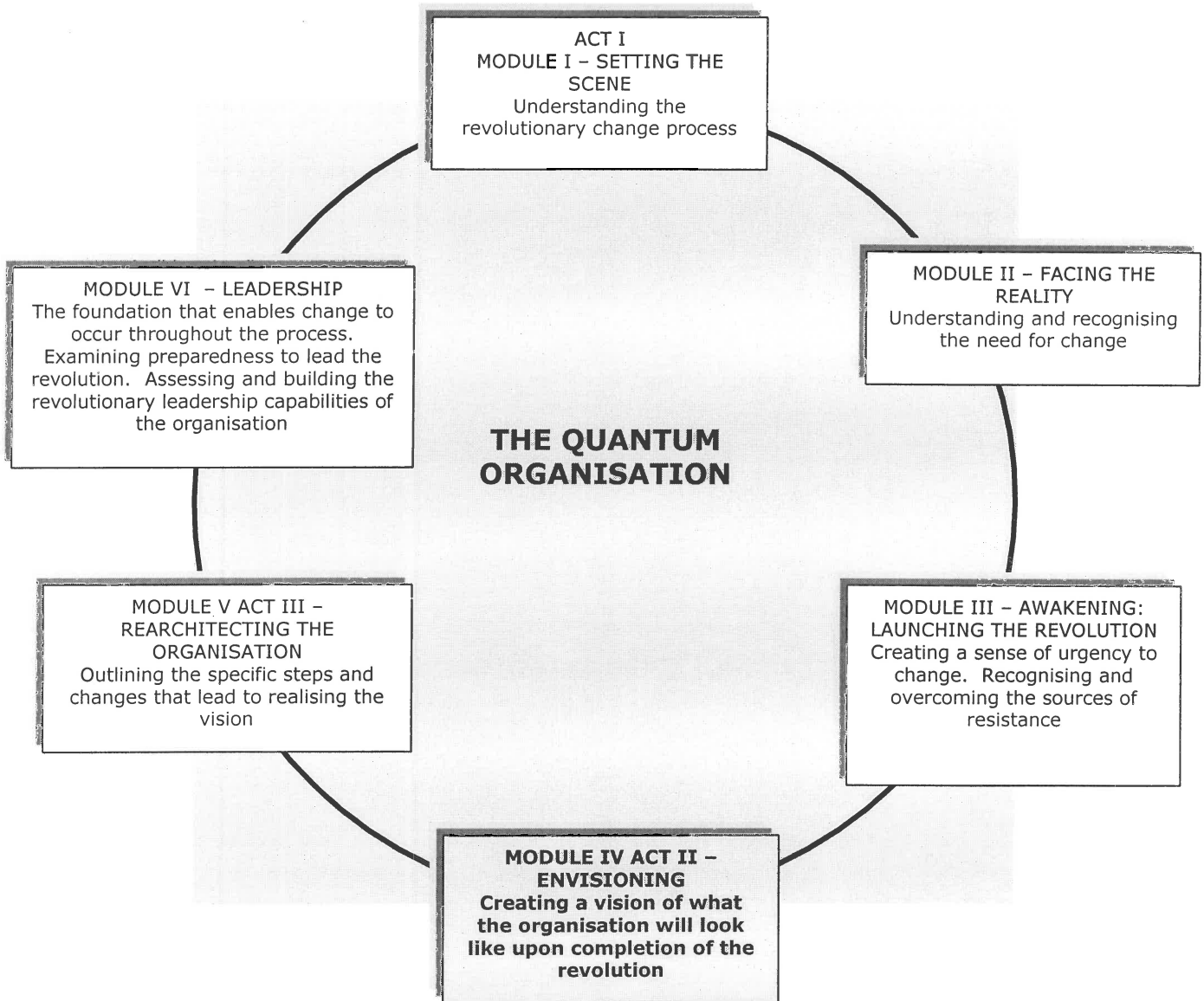
CREATING A NEW VISION



MODULE IV – ENVISIONING TWENTY-FIRST CENTURY TAYLORISM: THE NEW LEVERAGE OF KNOWLEDGE AND INTELLIGENCE

'In the first place, the true philosopher is devotedly fond of wisdom in all its branches. And here we must carefully distinguish between the genuine and the counterfeit lover of wisdom, ... the former (genuine wisdom) is never satisfied until he has penetrated the essence to Beauty itself. The intellectual state of the latter (genuine wisdom) may be described as real knowledge or science.'

Plato: xxii





MODULE OBJECTIVES

In this module, the evolution of data, through information, through knowledge to business intelligence, is explored. Ways of deriving knowledge (internally within the organisation as well as through external sources) are explored. The module focuses on the re-engineering diamond as a framework for the relationship between information and business systems.

In this module we study the notions of information systems (IS) and information technology (IT), define these interrelated concepts and explore the evolution of IT and ways of forecasting new trends. The IT Strategic Grid and the Strategic Relevance Grid are explored as a means of addressing BPR's failures. A matrix of information delivery systems is proposed from which organisations have to choose their IT implementations and investments. Measures for calculating ROIT are discussed. The notion of TCO is also put into an IT investment perspective.

The choice of the term 'business intelligence' according to Simon's stages of decision making is justified in order to develop and evaluate information delivery systems in the subsequent module (Module V) and to justify the choice of information delivery (that of business intelligence) as a vehicle for change.

Although the term 'database' (DB) is retained, the author prefers the term information warehousing to the more common term of 'datawarehousing' – so as to be consistent with the proposed differences and levels of knowledge and intelligence for decision-making. Information warehousing is also proposed for organisations to compete on the new platform of business intelligence. In this context, different information delivery systems are compared in terms of key product, comparisons are drawn and possible new trends identified.

Finally, it proposes models for IT implementation and evaluation – the IT Strategic Grid Model and the Strategic Alignment Model for organisations to craft and create competitive advantage through IT.



1. INTRODUCTION

'Change' is far too mild and misleading a word to use to account for the market chaos businesses face today. Civilisation and society are re-invented through technology and the evolution of new technologies.

Throughout history, people have characterised their existence by time periods or eras. There have been the Ice Age, the Renaissance, the Agricultural Age and the Industrial Age. Module I explored the transition into a new era that is totally different from the previous ones. This is known as the Information Age – an age in which knowledge is power. More than ever before, businesses are having to transform their ways of doing business. Using information, getting knowledge and business intelligence out of data, is the new platform of competitive advantage. This means that whatever (information) they do not possess and use, is a source of competitive advantage for the competition. Businesses have to realise the true value of information and act upon it (timeously).

In the Information Age, basic economics is turned on its head [Drucker 1998b]. The new basic resource (information) differs radically from most other commodities in that it does not follow the scarcity theorem. On the contrary, it follows an *abundance* theorem, leading Drucker [1998b: 168] to write:

'If I impart information, I still have it and can sell it again and again. ... it is clear that it will force us radically to revise basic economic theory.'

Drucker [1993] was the first to refer to the Knowledge Society which distinguishes itself from the past in the key role it plays within society. He argues that, in the new economy, knowledge is not only another resource alongside the traditional factors of production (land, labour and capital) but the only meaningful resource. The fact that knowledge has become *the* resource, rather than *a* resource, is what makes the new society unique.



Toffler [1990] echoes Drucker's contention, proclaiming that knowledge is the source of the highest quality power and the key to the power shift that lies ahead. He argues that knowledge has shifted from being an adjunct of money power to being its very essence. He sees knowledge as the ultimate replacement for other resources.

Quinn [1992] shares their opinions, and adds that the value of most products and services depends significantly upon knowledge-based intangibles (technological know-how, product design, marketing presentation, understanding the customer and innovation). In this society, the knowledge worker is the single most important asset, since he knows how to allocate knowledge to productive use (similar to the capitalist allocating capital to productive use). The capacity to *manage* the knowledge-based intellect is fast becoming the critical executive skill for coping with the Information Wave economy.

Reich [1991] contends that the only true competitive advantage will belong to those equipped with the knowledge to identify, solve and broker complex business problems.

Information does not generally belong to a specific industry or business. It does not have any end use, nor does any particular end-user require a particular kind of information. One implication is that non-customers are as important as customers. Another is that non-customers are more important than customers. It is believed that they generally constitute at least 70% of the market potential [Drucker 1998b: 169]. They are the possessors of information on why they are not customers of that particular business. Drucker [1998b] contends that changes generally start with these non-customers – who they are, where they are and the reasons they are. Information and the subsequent IS, are generally obtained, stored, assimilated and retrieved through IT. Thus, both focus on information – IS on the *demand* side of information and IT on the *supply* side of information. This link (and subtle difference) between IT and IS can best be summarised in the matrix below, according to which the two sides are both deployed to create value (in this instance, information and business intelligence) from data (Refer to the value chain of data proposed in Section 1.1).

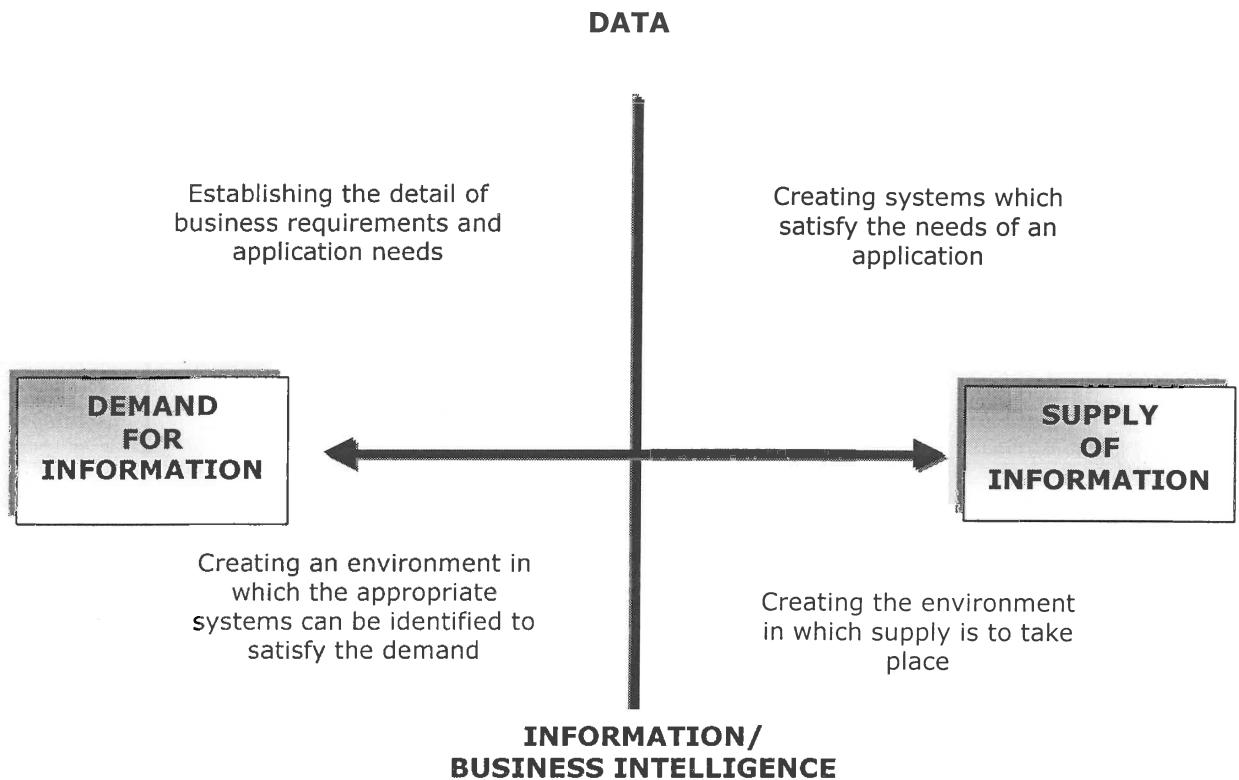


Figure 11: The proposed link (and difference) between the systems and technology sides of information

The value of information is difficult to determine. Information may be deemed highly valuable or it may be deemed worthless – especially with the growing notion of information as an essential product and valuable resource. This idea of value through information is difficult to describe and, sometimes calculable and other times not. Broadly, it is contended that the calculable value of information has two dimensions:

- There is value in the *exchange* of information: Essentially, value in exchange is calculated (or known) by the amount of money for which the commodity information exchanges hands.



- There is value in the *use* of information: The value of information in this instance, lies in the difference between expenses incurred in extracting or producing the information and the costs incurred in doing so. Unlike value in exchange, value in use is far more difficult to calculate because it has to be calculated by other means than the amount of money for which it actually changes hands.

It would therefore seem that the cost of information lies more in the cost the prospective buyer may incur in not buying from a specific vendor or, more to the point, not having access to the information (or intelligence). In putting a Rand value on information, it is suggested to follow the approach suggested by Haag, Cummings and Hawkins [1998] whereby information needs are identified according to three dimensions of needs, termed dimensions of information.

These are:

- Time,
- content and
- form.

These will be discussed below as they have relevance on one of the dimensions (the information dimension (Module II) that helps explain the failures of BPR and which will be discussed again in Module V. Through the above dimensions it is possible to define and identify the characteristics of information that is of specific value to an organisation.

- (i) *The time dimension of information:* This deals with the *when* aspect of information, that is, a timeliness issue. It is not possible to make the correct decision at the correct time without the correct information at hand. It also includes a currency characteristic insofar as the information has to be up to date otherwise it is of no strategic value to leadership and of no use to the knowledge worker.



- (ii) *The content dimension of information:* This is generally considered the most critical dimension of information. It deals with the *what* aspect of information and characteristics include accuracy, relevance and completeness. The modern IT environment, can easily lead to an information overload with information available that is not relevant or that is impossible to assimilate - the latter aspect will be addressed in terms of the information delivery matrix – especially within the business intelligence/information warehousing context [Figure 19] in this module.
- (iii) *The form dimension of information:* This dimension deals with the *how* aspect of information and includes detail (or information granularity or resolution) and presentation (graphically, video or special technology).

In conclusion, it is strategically important, using the above dimensions of information, to ensure that an organisation has the right information (content) when they want it (time) and how they want it (form). These are driven by the two sides of information (refer to Figures 11 and 12) and to be discussed below.

In the schematic presentation below, the two sides of information are differentiated as that pertaining to the strategic importance of the business and that which is of a more operational value. As a consequence, both present different leadership (or decision-making) roles to the business. Note that this thesis will focus more on the strategic information aspects than those of an operational nature.

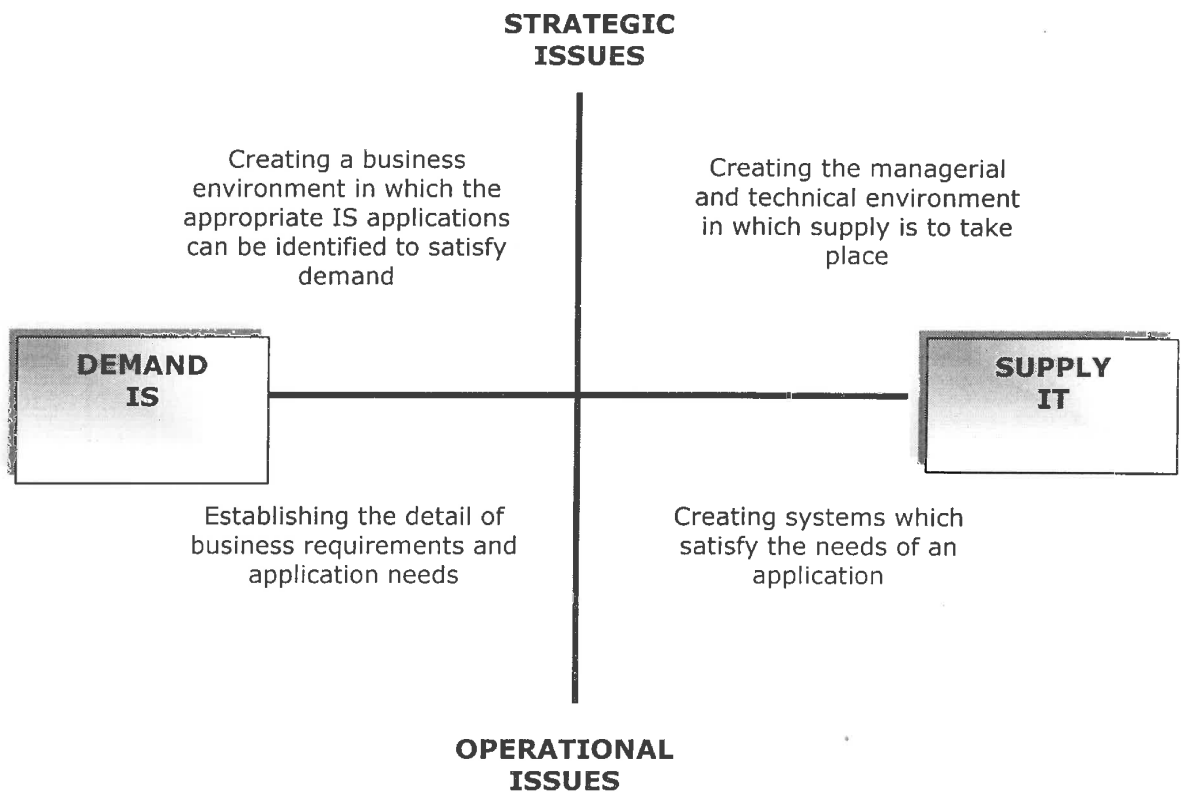


Figure 12: Differentiation between strategic and operational information issues
After Edwards, Ward and Bytheway, 1995

The above scheme leads to differing leadership and managerial roles through the use of IT and IS as strategic and operational tools. Traditionally, these two related sides of information generate different decision roles and structure roles within the organisation. These are summarised in Figure 13 below.

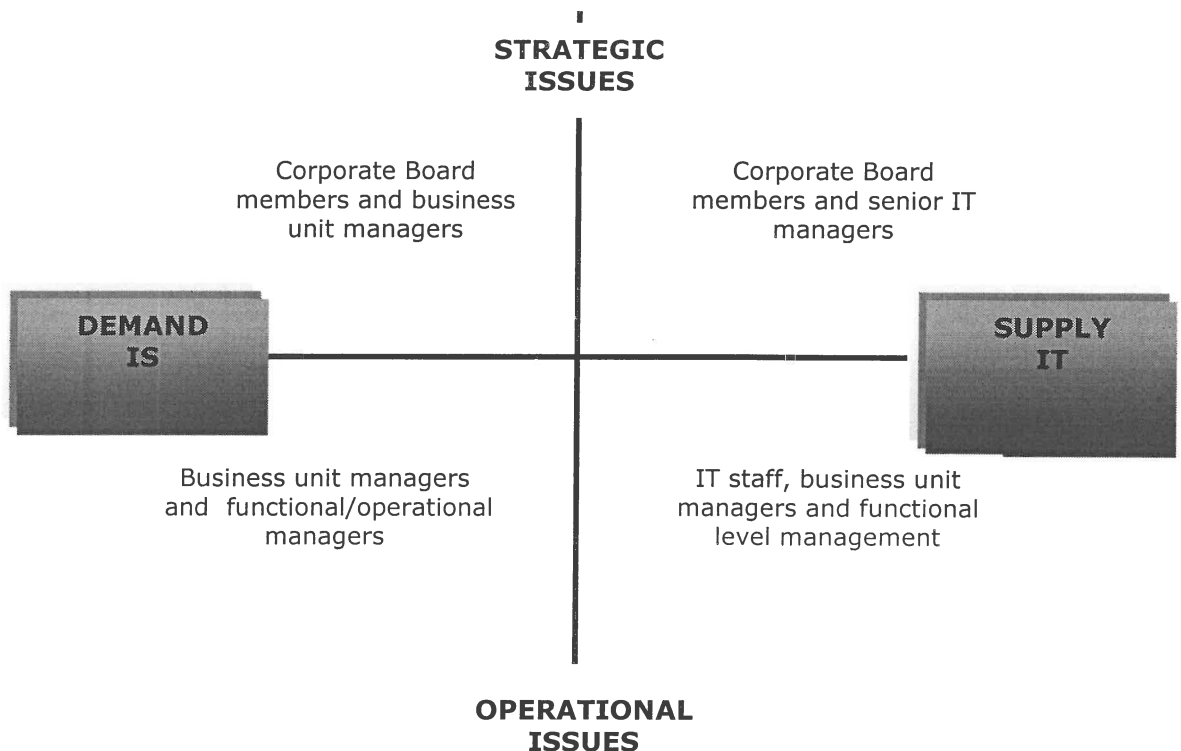


Figure 13: Different roles pertaining to the two sides to information
After Edwards, Ward and Bytheway

Whether, within the new organisational structures proposed in this thesis, these roles are still so absolute, is debatable. **One of the objectives of this thesis is to develop a generic model for organisational knowledge creation and business intelligence.**

1.1 THE NEW AGE OF THE BUSINESS INTELLIGENCE ECONOMY

The study of human knowledge is as old as human history itself. It has been the central subject matter of philosophy and epistemology since the period of the Greek philosophers. Drucker and Toffler are two business theorists who call attention to the importance of knowledge as a business resource and a source of power. Using knowledge as the new competitive advantage calls for a



fundamental shift in thinking about the business organisation. The focus is not only on the *process* of knowledge, but also on *creation* of that knowledge.

As with most arenas in the business world, there is strong evidence to support the belief that Japanese companies' understanding and use of 'Knowledge creating' companies is the most important reason for their successes. In other words, in the Japanese culture, the organisation acts as medium for knowledge creation. In Western culture on the other hand, the individual is the principal agent to possess and process knowledge. However, it is suggested that the individual interacts with the organisation through knowledge.

Thus, knowledge creation takes place at three distinct levels:

- Individual,
- group and
- organisation.

[After: Nonaka and Takeuchi, 1995]

In order for an organisation to qualify as a knowledge-creating company, it must possess the organisational capability to acquire, accumulate, exploit and create new knowledge continuously and dynamically. It must also have the ability to recategorise and recontextualise such knowledge strategically for use by others in the organisation. This goes beyond organisational learning [Nonaka and Takeuchi, 1995]. It touches on the links between the conventional business systems and structures, and the IS ones summarised below.

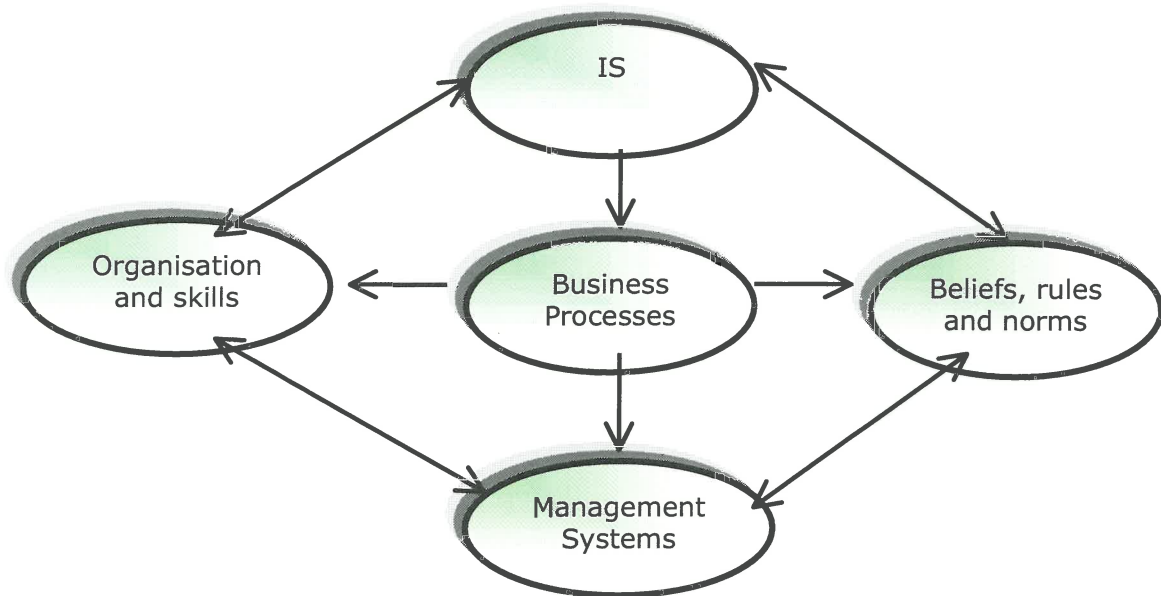


Figure 14: The Re-engineering diamond as framework for the relationship between the information and the business systems

Source: CSC Foundation, 1996: 3

The above scheme is especially important for its critical role in providing a link between the organisation's business processes and its IS which will be studied in detail in Module V and forms part of the focus of this thesis. It follows that any re-engineering exercise an organisation embarks upon, will of necessity involve the IS and information flows in the organisation and vice versa. Which should be addressed first is debatable and this question will also be addressed in Module V.

Conventional organisational structures are not flexible enough to perform the functions identified by Nonaka and Takeuchi [1995]. They propose the *hierarchy* as the most efficient structure for the acquisition, accumulation and exploitation of knowledge, while a *task force* is the most effective structure for the creation of new knowledge. Recategorising and recontextualising the knowledge created through these two structures, necessitates the establishment of a third layer, called the *knowledge base*. The latter does not exist as an actual organisational entity, but is embedded in the prevailing vision, culture or technology. It is suggested that the organisation moves into the sphere of self-organisation (Module III) or, alternatively, the *hypertext organisation* that can accommodate all three layers. In hypertext, all three layers are accommodated. The



knowledge base layer overlays the other two layers. This ability to switch from one layer to another, is the fundamental strength of the hypertext organisational structure, as opposed to the more conventional forms. The three levels in the hypertext organisation are summarised below.

Table 8: Summary of the hypertext organisation’s ability to manage knowledge (inside and outside the organisation) at different levels

LEVEL OF KNOWLEDGE	BUSINESS PROCESS
Acquisition, accumulation and exploitation of explicit knowledge	The business system layer in a hierarchy
Creation of new and tacit knowledge through conversion	Task force
Storage and reinterpretation of tacit and explicit knowledge	Knowledge base layer

It is not easy to convince managers used to the conventional either/or style to view hierarchy and task force as *complementary* (as opposed to mutually exclusive) within a larger Competing Values Framework - this will be studied in Module V. However, according to Nonaka and Takeuchi [1995] there are distinct advantages in successfully implementing this framework:

- Employees have an easier method of decision-making at their disposal since they only have to use one layer at a given time.
- There are no dual functions as there are in a matrix structure.
- The quality of knowledge tapped into by the organisation increases with the resultant specialisation.

It may take time to switch to this type of loose organisational structure and it will require a total commitment from the workforce. For those who get it right, the rewards will be in the competitive advantage that the added knowledge gives them. The Japanese company, SHARP, has already made the switch to this structure with huge success.

Up to this point, the terms, 'knowledge' and 'information' have been used interchangeably. However, most theorists agree that these concepts, although related, differ in application and level.

The following knowledge levels for decision-making are mentioned – each building upon the previous one. These levels are mentioned here for purposes of comprehensiveness, while a more simplistic value chain will be introduced.

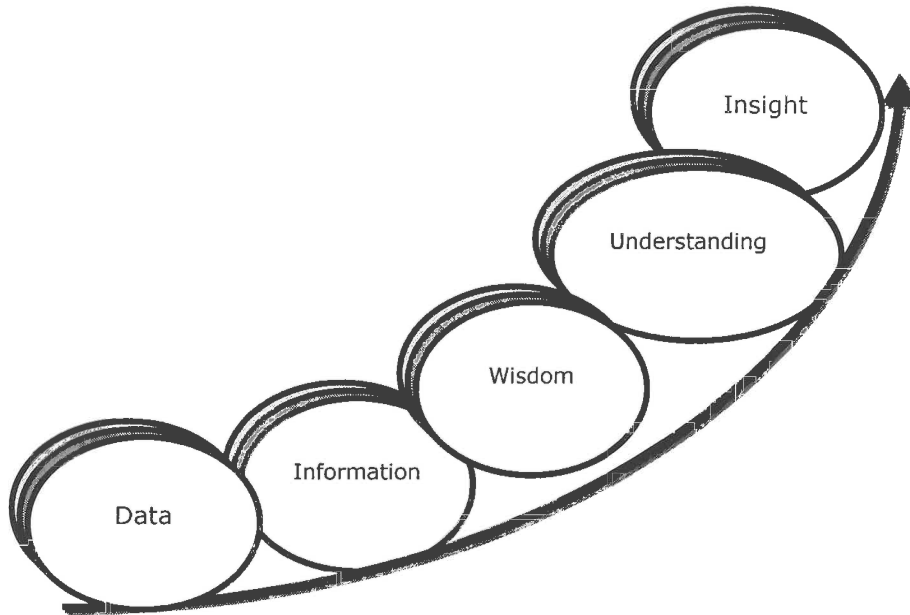


Figure 15: Knowledge levels for decision-making
After Laudon and Laudon, 1997

These notions are defined in the table below:



Table 9: Definition of terms

Data	Streams of raw facts representing events before they have been organised and arranged according to some criteria into a usable and understandable format
Information	Knowledge about how things fit together statistically
Understanding	Knowledge about the system's external relationships
Wisdom	Knowledge about 'what' (regulation) keeps things together
Insight	Knowledge about how things fit together dynamically

After: Laudon and Laudon, 1997

These notions are expanded upon through the modes of inquiry summarised in Table 10:

Table 10: Modes of inquiry

	STRUCTURE	PROCESS	FUNCTION	REGULATION
PERSPECTIVE DESCRIBES	Which things and how things fit together statistically	What happens, sequence, time related	What is the role, what is achieved. How things fit into the whole	Why things stay together. What keeps things together. Related to interaction
CATEGORY OF KNOWLEDGE	Information: Know what is	Insight: Know what happens	Understanding: Know why	'Wisdom': Know why
MODE OF INQUIRY	Analysis	Flow tracing	Synthesis	Inquiry into stability

After: Laudon and Laudon, 1997

In contrast to the foregoing (Figure 15) this author will consider only three knowledge levels in proposing the following value chain of data as it pertains to business:

Business data → Business information/knowledge → Business intelligence,

the last-mentioned being the consequence of the proposed study in this module (Section 3.3), in terms of the acquisition of business intelligence as the ultimate form of competitive advantage.

The answer to the question '*Why the focus on knowledge?*', lies in the power of knowledge as a decision-making tool. An organisation's business intelligence base (accumulated outside and shared widely within) can be used to develop new technologies and products. Some conversion takes place with regard to the business intelligence:

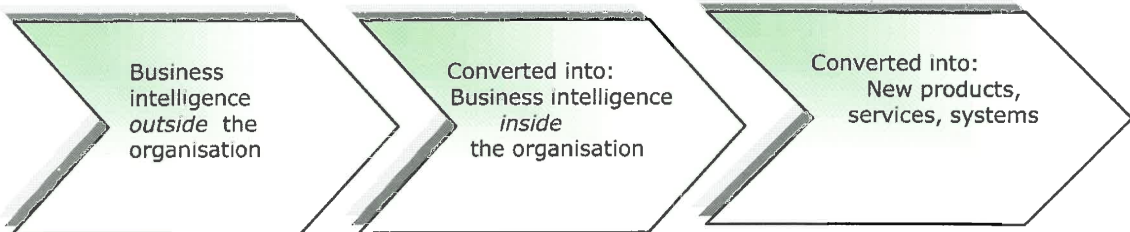


Figure 16: The transformation process of business intelligence

This dual external/internal role of business intelligence is the key to competitive advantage. This is summarised in the following scheme.

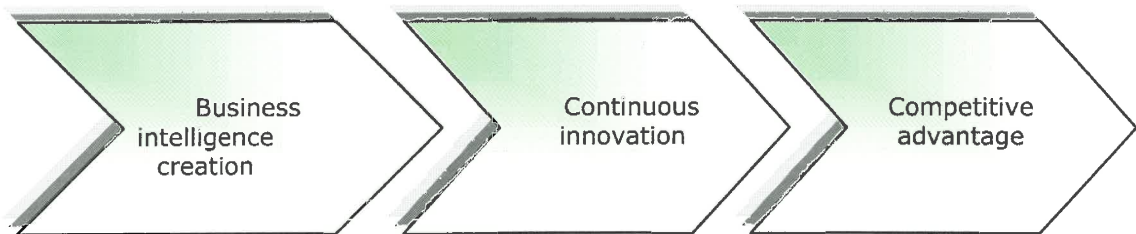


Figure 17: Competitive advantage gained from business intelligence



The term (business) 'intelligence', which is this author's choice of term, relates to

'.. the identification and understanding of problems occurring in the organisation – why the problem, where and with what effects.'

Laudon and Laudon, 1997,

whereas Mallach [1994: 679] notes

' (intelligence) the first of Simon's four phases of decision-making, which consists of finding, identifying and formulating the problem or situation that calls for a decision.'

And Schultheis and Sumner [1992: G-8] agree

' .. (intelligence) the first phase in the decision-making process in which the decision maker searches for conditions calling for a decision such as a problem or opportunity.'

Thus, for the purposes of this research, the term (business) 'intelligence' will denote the identification of business opportunities for change through appropriate information (technology and systems). This follows from the four stages of decision-making described by Simon [1960]. These are summarised in Table 11.

Table 11: Simon's four stages of decision making – with feedback at any stage to the previous stage

INTELLIGENCE	Is there a problem?	Information gathering to identify problems in the organisation
DESIGN	What are the alternatives?	Conception of possible alternative solutions to the problem
CHOICE	Which should you choose?	Selection from the various alternative solutions
IMPLEMENTATION	Is the choice working?	Implementing the decision and reporting on the progress made from it.

Source: Mallach, 1995



Finally, it is important to place in context, the different kinds of decision making that may follow from the information delivery in a subsequent section. These are summarised in Table 12.

Table 12: Different IS purporting to different organisational levels

	OPERATIONAL	KNOWLEDGE	MANAGEMENT	STRATEGIC
Structured	TPS	OAS	MIS	
Semi-structured			DSS	
Unstructured		KWS		ESS

These, together with their applications and future roles, will be discussed within the context of the information delivery matrix in Section 3 [Figure 19].

2. THE NEW TECHNOLOGY – A REVOLUTION

‘One of the tools which shows the greatest immediate promise is the computer, when it can be harnessed for direct, on-line assistance, integrated with new concepts and methods ... Every person who does thinking with symbolised concepts (whether in the form of English language, pictographs, formal logic or mathematics) should be able to benefit significantly.’

Douglas Englebart, 1962

Almost forty years later, the (almost) revolution (not evolution) in technology substantiates Englebart’s vision. He was arguably the first person to look beyond the existing paradigm of data processing at that time to an envisaged new paradigm in technology. He (Englebart [1962]) subsequently conducted a Knowledge Workshop. Knowledge workers were directly supported by networked workstations providing sophisticated communications, information handling and decision support tools. The system contained a number of inventions. Users manipulated a gimmick called a ‘mouse’ for cursor control; they went beyond data processing using an invention called ‘word processing’; electronic documents



were contained (and were linked) through a complete structure called 'hypertext' (the basis of today's Internet); and users were on-line and could communicate with one another through something called 'electronic mail'. Most importantly, the system was not used by so-called operators, but by knowledge workers and the system was not designed to automate but as a communications system to support employees [Englebart, 1962].

2.1 THE EVOLUTION OF IT

Before the strategic application of technology can be addressed, it is important to formally define IT. Definitions of IT depend largely upon the evolution of IT, since most authors agree that IT has moved from back-office applications to front-end strategic use. According to Venkatraman, Henderson and Oldach [1993],

' .. IT has become the generally accepted term that encompasses the rapidly expanding range of equipment (computers, data storage devices, network and communications devices), applications and services (end user computing, help desk, application development) used by organisations to deliver data, information and knowledge. It provides strategic value to all parts of the business.'

According to Senn [1998: 12],

' IT refers to a wide variety of items and abilities used in the creation, storage and dispersal of data and information as well as the creation of knowledge.'

It seems that these generic definitions have one thing in common, that is that they broadly define the concept of IT application, depending on its evolution. In this regard, study Figure 18.

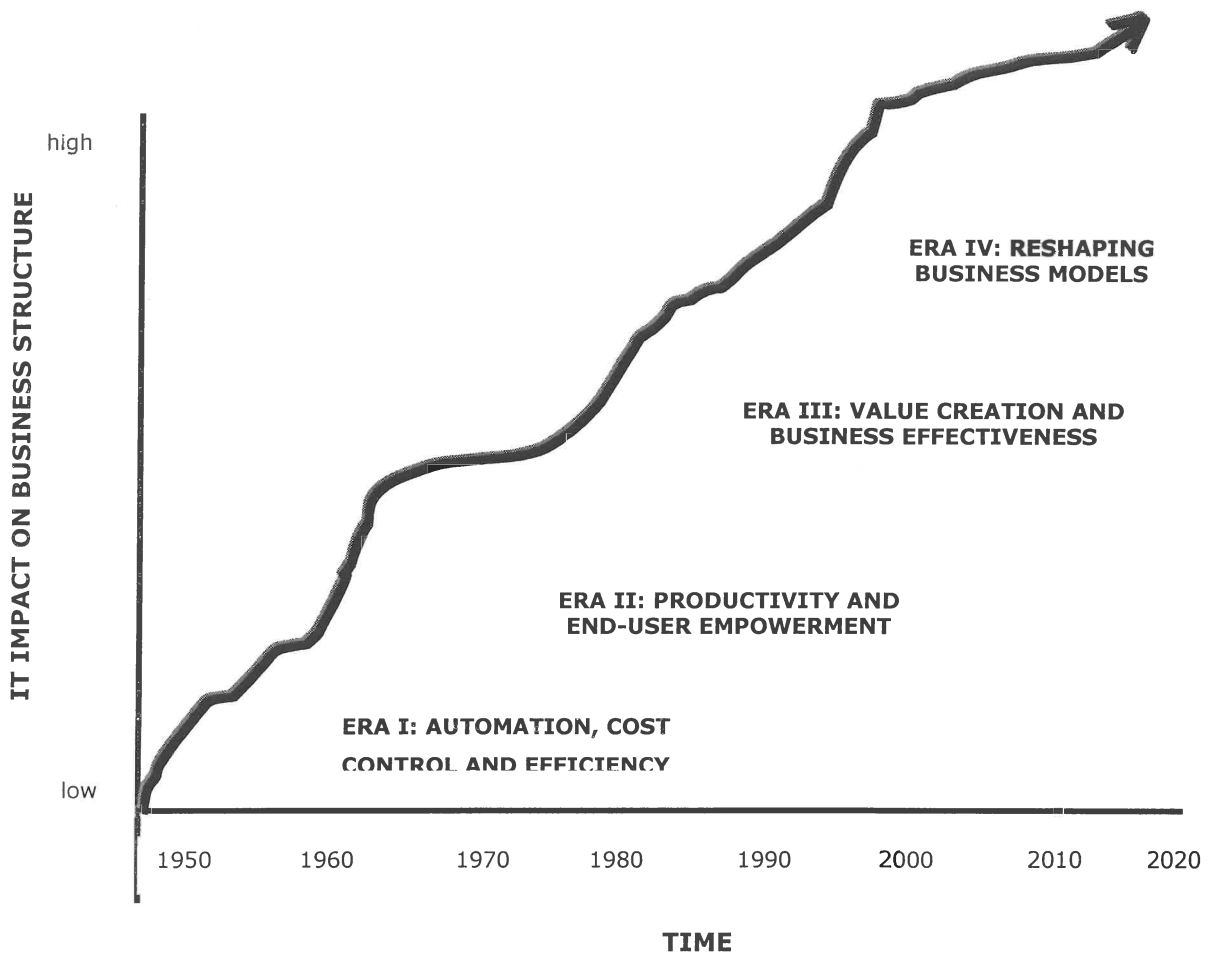


Figure 18: The evolution of IT in terms of investment drivers, technology cycles and change
After: Gartner, 1999

The evolution of IT in the organisation: In place of the term 'IT', the more descriptive acronym ITT (IT and Telecommunications) may be used as this encompasses the essential component of telecommunications [Geisler, 1997]. ITT has evolved from a tactical tool to rationalise and to automate back-room operations of accounting payroll. In modern times, it is of strategic value to organisations in assimilating and reporting the accumulated knowledge and experiences in the organisation. Figure 18 shows the learning curve of ITT as incremental and cumulative. Data processing and back-room operations are still



practised, but organisations have mastered the intricacies of these functions as they move along the sophistication curve toward ITT as a strategic tool.

It is generally agreed that IT applications should be designed in such a way as to have an impact on the individual, the functional unit and the organisation as a whole. It is this author’s belief that this also serves as the progressive evolution of IT and thus proposes the following framework (and evolution) of IT application which will be developed in Module V in terms of IT’s use in re-engineering and transformation.

Table 13: Application framework for IT, highlighting its evolution

	ROLES OF IT	INDIVIDUAL	FUNCTIONAL	STRATEGIC
Efficiency	Administrative	Task mechanism	Process automation	Boundary extension
Effectiveness	Operational	Work improvement	Functional enhancement	Service enhancement
Transformation	Competitive	Role differentiation/ expansion	Functional redefinition	Product/process/ business innovation

The above three roles of IT form part of the IT evolution addressed earlier. In an administrative capacity, the scope of IT embraces the automation of accounting and control functions, whereas IT’s operational role, although an extension of the first, is distinguished by the creation and deployment of a technology platform that creates the capability to automate the entire set of business processes as opposed to only the administrative activities. However, along the same principles of viewing strategic management in terms of a hierarchy of three levels of strategies - these being: *corporate strategy* (concerned with the portfolio of and interrelationships among businesses), *business strategy* (focusing on developing a strategy that maximises organisation-specific comparative advantages to best compete in the marketplace) and *functional strategy* (reflecting efficient allocation of resources to the particular function) - the existing IT strategies have generally reflected an internal efficiency focus. However, the capabilities now exist for organisations to deploy new IT applications that use the information and technological attributes as leverage to obtain differential sources of competitive advantages in the marketplace.



This framework is in agreement with Figure 19 (which may be superimposed on Figure 18) below which proposes IT's evolution in terms of four eras (– the latter to be realised by 2000) in terms of investment drivers, technology cycles and change [Gartner 1999]. Era III corresponds to the notions of BPR to be discussed in Module V, whilst Era IV corresponds to the greater notion of re-engineering the business itself (Figure 18).

The increased attention devoted to IT to influence structural characteristics in the organisation and its markets is a concern addressed in Module V. In this, emerging IT has significant implications for organisational transformation – especially because the mere superimposition of powerful IT capabilities on existing organisational structures and processes is unlikely to yield superior competitive benefits. This contention is supported by an MIT Research Project which found that successful organisations can be distinguished by their IT leverage capabilities to transform their businesses (structures, roles and processes in Figure 14) to obtain powerful and new sources of competitive advantage. In this context, the existing frameworks [Porter's Value chain Analysis, Business Systems Planning and Critical Success Factors] are limited because of their operational focus. Section 3 proposes two frameworks for strategic IT implementation, namely the IT Strategic Grid and the Strategic Alignment Model.

With regard to the differences in needs between the Industrial and Quantum Eras described in Module I, the following reflections are of interest:



Table 14: Different IT applications between the Second and the Third waves

	INDUSTRIAL AGE	DIGITAL AGE
Primary tool	Machines	Information creation, distribution and application
People	Division of labour	Connectivity of workers through: Teams, Interconnectivity, Shared information
Productivity	Mechanisation and automisation	IT
Partnership	Partnership between man and machine	Partnership of people with people

The above applications reflect the evolution from an Organisation-as-Machine (Second Wave) perspective to the Organisation-as-living-Entity perspective (Module III, Section 5) of the Third Wave and will be discussed with regard to multidimensional IT models and their application in BPR (Module V, Section 4.1.3).

2.2 TECHNOLOGICAL FORECASTING

'Decisions exist only in the present. The question that faces the long-range planner is not what we should do tomorrow, it is: What do we have to do today to be ready for an uncertain tomorrow? The question is not what will happen in the future. It is what futuristics do we have to factor into our present thinking and doing; what time spans do we have to consider, and how do we converge them to a simultaneous decision in the present?'

Drucker, 1970

According to Drucker's beliefs as stated above, all that is certain about the future is that it will be different from the present or the past. Since technology is responsible for many of the most important changes in society, forecasting future advances in technology, as well as their impact, will have a significant effect on



the organisational strategy. The planning horizons for organisations are becoming much shorter [Burgelman and Maidique, 1988] and in this regard, it is important to note the evolution of IT (Module II) and emerging trends.

A number of shifts in the nature of technology itself are driving forward the convergence of computing, communications and content technologies and industries. These shifts create the power, capabilities and price performance for new media, a new organisation, a new economy and a new society. Leadership does not have to become a technology expert, only to understand the main shifts that are under way and how these can be used for competitive advantage.

The ten most important technology shifts are [Tapscott, 1996]:

Table 15: Technology shifts for competitive advantage

TECHNOLOGY	FROM	TO	
Signal	Analogue	Digital	Digital economies for the digital economy
Processors	Traditional semi-conductor	Microprocessor	High performance processing for the high performance organisation
System	Host-based	Client server	Networkcentric computing for the Internet worked enterprise. Client/server computing for the dynamic client/customer service organisation. The network becomes the computer. The enterprise becomes the network
Network capacity	Garden path band width	Information highway	Broad band communications for the networked economy
Device	Dumb access	Information appliance	Smart on and off ramps for the information highway
Information forms	Separate data, text, voice, image	Multimedia	Interactive multimedia for complete human communications
System	Proprietary	Open	Open systems for an open world
Networks	Dumb	Intelligent	Hypermedia and letting the agent do the walking through the Net
Software development	Craft	Object computing	Rapidly deployable software for the rapidly changing world
Interface	GUIs	MUDs, MUIs and MOOs	New collaborative environments for a new economy



It is suggested here that organisations would do well to invest in so-called technological forecasting as part of their strategic inventions. Granted there is a degree of uncertainty in the outcome of such research. Nevertheless, an attempt should be made to utilise this costly and ever-expanding innovation. This may also take the form of an analysis of the strengths, weaknesses, opportunities and threats (SWOT analysis) of current and future technologies, scenario-building activities and statistical techniques. Technology cannot be looked at in isolation – there is strong evidence of interactions between the political, technological and social forces in the organisation [Tichy, 1993]. This will be discussed further in Module V (Figures 30 and 31 respectively). An example of this is the development of the NASA space programme, which was not based entirely on technological innovations, but also on the nature of the race between the United States and Russia.

Although there are two schools of thought, this researcher agrees with Drucker's [1970] argument that, contrary to some contentions that the evolution of technology will follow the normal life cycle approach (Handy's S-curve in Figure 4), technology will create new technology, which makes any serious attempt at technological forecasting almost, if not entirely, impossible. It consequently increases the value of technological innovation significantly.

Luftman, Lewis and Oldach [1993] believed at that time, that the rate of change at which new technology is introduced is increasing between twenty and thirty per cent annually, impacting on:

- The demand to apply state-of-the-art technology strategically and
- accelerated innovation.

They confirm that technology will continue to increase and be magnified by new network communications opportunities.



2.3 TECHNOLOGY INNOVATION

In Module I it was noted that Drucker believes technology to create technology. Moreover, there has been an evolution from people as decision-makers to a combination of people and machines as joint decision-makers. Artificial intelligence has managed to outperform humans in specific areas, like optimising production schedules or detecting patterns in financial data, and multimedia technologies provide new and unprecedented ways for educating and informing people. Despite these advances, it is not yet possible for machines to think like people. However, business is becoming more and more dependent on the capabilities of IT and the role of machines in better decision-making. The trend is towards closer co-operation between man and machine, the main question being what combination of man and machine will work best.

It is important for organisations to establish technology innovation principles to ensure that the technology innovation process is successful. To achieve this, leaders and IT professionals should share a vision of the role of enabling technologies and their respective commitments to realising this vision. Jointly developed technology innovation principles lay the foundations for this shared understanding and provide a framework for innovation activities. These should be embedded in the shared values of the organisation, rather than expressed in technical terminology. The development of shared technology innovation principles will establish a dialogue and joint vocabulary with regard to technology innovation. The CSC Foundation Index proposes [1998] that leaders and IT managers converge to develop principles based on the following categories:

- Relationship to business strategy,
- pace of technology innovation,
- roles in the technology innovation process and
- funding for technology innovation.

These are expanded upon below.



- (i) *Relationship to business strategy:* This entails identification of the roles for enabling technologies in the business strategy, especially since advanced technologies are key spurs for BPR projects, and the advancement of technologies may address the pursuit of business value in the chosen value discipline. (Refer to Figure 9.)
- (ii) *Pace of technology innovation:* This is concerned with the urgency and adaptability issues of the technology infrastructure.
- (iii) *Roles in the technology innovation process:* Issues revolve around the organisational commitment to technological innovation and collaboration between leadership and IT managers.
- (iv) *Funding of technology innovation:* This pertains to the percentage of the budget allocated to technology innovation and shows the level of commitment in this regard.

The above principles should be clear and compellingly communicated to employees who are involved in decision-making. The focus should revolve around the implications of the principles and the dominant value discipline that the organisation is pursuing. Technology innovation is sure to become a required IS competence in the Quantum Era.

The principle of technology innovation will be addressed again insofar as multi-dimensional IT models for BPR are concerned, in Module V.

2.4 THE COSTS OF IMPLEMENTING IT

Laudon and Laudon [1997] believe that computing costs are decreasing tenfold every decade, whilst capacity has increased at least a hundredfold. According to Violino [1998], clearly defined financial planning for IT-based projects is becoming standard procedure. The days of 'gut feel' justification of new technology have passed. He argues that executives have been inundated by year



2000 efforts and regular IT shortages, causing substantial salary increases for IT personnel. He believes that:

*'With any new development project – whether it is for cost saving, new product development or marketing, we must forecast returns ...
It has become so easy to spend a lot of money on hardware, software and maintenance – and not see any returns.'*

The costs of implementing IT will be discussed next from the following two perspectives:

- Total cost of ownership (TCO) and
- Return on investment IT (ROIT).

2.4.1 A TCO PERSPECTIVE

'Total cost of ownership' is the phrase used to describe all costs associated with the acquisition, use and maintenance of goods or services. This approach examines costs associated with IT-related purchased goods and services throughout the supply chain. Presently, no standardised description for TCO exists, although the preferred link is that of the degree of customer satisfaction. According to Saunders [1994: 118],

'TCO is designed as all costs associated with acquiring, possessing and sustaining a conforming product as it exists throughout its life cycle',

and thus identifies three issues pertaining to specific cost areas using TCO. These are:

- Acquisition,
- possession and
- sustenance.

The above will be expanded upon below.



- (i) *Costs pertaining to the acquisition of the product or system:* These refer to all costs concerned with ensuring the conformance of the product.
- (ii) *Costs pertaining to the possession of the product or system:* These refer to all reactive costs that ensure that the conformance and compatibility will be adhered to in the future.
- (iii) *Costs pertaining to the sustenance of the product.* These costs refer to the implementation and running of the system.

Therefore, one may say that TCO is a structured approach for determining the total costs associated with the acquisition and subsequent use of a given product or system from a supplier, or the analysis of the total cost of the acquisition per se. It is a comprehensive approach that goes beyond price alone in considering other costs, including non-value-adding activities, service costs, failure costs, administrative costs, maintenance and life cycle costs – all of which are relevant in the IT environment.

A useful framework for structuring TCO is given by Ellram [1993] and is adapted here for IT acquisitions and implementations. From Ellram's model and bearing in mind the IT-specific requirements, TCO may be subdivided into three subcategories.

These are:

- Pre-transaction components,
- transaction costs and
- post-transaction costs.

These are explored below.

- (i) *Pre-transaction components:* These consist mainly of the cost of investigating alternative systems and qualifying and educating suppliers and vendors in terms of the supply base.



- (ii) *Transaction costs:* These consist of the price of the system (including the service component), the cost of ordering and delivering the system (including hardware and software installations), inspection costs, quality inspection and control procedures and, finally, the cost of payment of the transaction.

- (iii) *Post-transaction costs:* These occur after the purchased item is owned by the organisation, in possession of the organisation and its customers and the complete integration and implementation are applied.

Conceptually, TCO differs from other investigative cost structure models in that it has a much broader perspective of the cost elements, which may impact on the cost acquisition, of ownership and of use. It should be emphasised that there is no standard model for TCO calculation. The number of factors and the accuracy in determining the various cost elements vary substantially. Most organisations start with one quadrant in the software delivery model proposed in Figure 19 (usually office automation) and subsequently build up to a more comprehensive system as the need arises. As a general guideline, one would expect TCO efforts to concentrate on high Rand value purchases, strategically important areas or areas difficult to manage – especially ones from which sourcing could be an alternative option or where the intelligence thus gained is of extreme importance to the strategic survival of the organisation.

One of the important applications of TCO is in the implementation of BPR, where a lack of data when mapping basic processes limits the BPR. This is particularly true for organisations where the BPR is the result of the impact of IT. In this instance, the availability of detailed cost data from the TCO framework, may contribute to the value and success of the BPR.

An implementation of TCO is provided by Ellram [1994] but this author suggests, in the light of TCO's relevance to BPR, a hybrid thereof following the basic BPR methodology. This is presented below.



Table 16: Suggested implementation model for TCO

ANALYSIS	Determine the basic desired benefits of TCO and the needs of the organisation Determine type(s) of purchases (systems) to analyse
DESIGN	Choose appropriate system (or mix) Choose cost (or value)-based approach
TRANSFORMATION AND IMPLEMENTATION	Form team to work on TCO approach Test TCO benefits and modelling approach Present findings to top management
EVALUATION	Fine-tune TCO analysis if needed Continuous improvement Expand the TCO concept along the supply chain

It should be noted that each step in the table above is extremely complex with a multitude of dimensions which have to be thoroughly considered. Moreover, each step is vital to successful TCO implementation.

In conclusion, the implementation of the TCO philosophy has a multiple impact on the supply chain. On the operational side, it contributes to improved supplier selection. Insight is gained into underlying cost structures along the supply chain and the need for appropriate systems. It provides management with information regarding a multitude of activities and it creates an awareness of the total cost of each product, system or service that is acquired by the organisation (or parts thereof). From a strategic perspective, TCO has its greatest influence on the supply chain, since, essentially, it focuses on the fundamental issue of satisfying customers at the lowest cost of acquisition, ownership and use. With customer (internal and external) satisfaction as the central force in organisations, TCO provides a quantitative perspective on this increasingly competitive strategy.

2.4.2 AN ROIT PERSPECTIVE

According to a survey conducted in January 1998 by Bartholomew [Violino, 1998], 50% of executives surveyed use some form of return on investment (ROI) metric for their IT projects, whereas a similar survey one year previously



indicated that only 20% of the respondents used a formal ROI measurement. On the other hand, some executives mentioned doing 'what if' scenarios because the competition did so [Davids, 1998]. The issue is further compounded by leadership's lack of understanding of the new IT capabilities and the fact that

'In many instances, these are things for which it is very hard to predict the return on investment. You have to believe in the concept.'

Steven Sprinkle, Deloitte and Touche, 1998

Most role players agree that their calculation of ROI on IT projects is very complex and often abstract. According to Riel [1998], the costs and benefits of IT within an organisation are far from obvious, probably causing many IT projects to fail.

He attributes this to:

- ❑ Budget overrun,
- ❑ schedule overrun,
- ❑ insufficient benefits, bad planning,
- ❑ bad business needs analysis and
- ❑ lack of proper project management.

Sweat [1998] maintains that the problem in calculating the ROI of IT is that IT is inextricably linked to all facets of the business, making it difficult to separate the ROI investment from that of other investments. According to him, IT managers often find traditional accounting methods (which look at the cost of an investment relative to revenue generated) meaningless. The reason for this lies in the fact that IT benefits are not always quantifiable in the traditional sense – mainly because IT investments may have long-term implications. This is corroborated by a study done by Wen, Yen and Lin [1998] in which they propose that the investment payoff on IT is difficult because most of IT's benefits are qualitative, indirect, diffuse and long-term. The actual measurement of the IT investment payoff should incorporate tangible and intangible benefit factors. The concomitant



risk factors should be identified and evaluated. (The different information delivery systems engendering these different tangible and intangible risk factors will be discussed in Section 3.3.)

One solution in determining the ROIT is that proposed by the Gartner Group. However, this is also largely dependent on subjective input although it makes use of research, consultation, strategic analysis and executive briefings to enable organisations to decide which IT initiatives are most in line with their strategic objectives. Another programme is that developed by the Concourse Group, called 'CEO/CIO Dashboard' [Sweat, 1998]. This programme enables customers to self-examine the proposed IT by looking at six aspects of IT operations, namely employees, internal operations, financials, innovation and learning, customer value and the value of the IT investment. For existing infrastructure, the service looks at the cost per unit, such as the cost of an electronic system per user. For new systems, the programme measures the economic value added (EVA) of the project on the business (the difference between after tax operating profit and the cost of the capital used to generate that profit. It subsequently looks at the cost of the IT portion as a percentage of the total cost. This ratio shows the percentage of value that can be directly attributed to IT. For example, if a new call centre produces a return of R10 million and the IT accounted for half that cost, then the IT return is R5 million.

Some organisations have adopted their own versions of EVA, one example being shareholder value added (SVA), which captures the amount of value created or destroyed by subtracting a capital charge from the profits generated by the project [Violino, 1998]. He concludes that the consensus amongst business analysts and IT managers is that there is no special formula to accurately reflect financial pay-offs for all IT projects in general. Analysts use different ROI measures depending on the complexity, scale and importance of the IT project under review. As an example of this, Violino [1998] cites the decision to upgrade PCs to newer versions of Microsoft Office. A simple cost/benefit analysis requiring a maximum of two days' effort will suffice, as opposed to the implementation of the SAP system which may require more complex ROI metrics and time.



Classification of relevant information technologies according to some scheme, could greatly reduce the complexities of this situation. This will be dealt with in the following section.

3. PROPOSED CLASSIFICATION OF INFORMATION TECHNOLOGIES

According to Riel [1998] the costs and benefits of IT within an organisation are far from obvious. Apart from tangible and intangible costs, Riel is of the opinion that there are also irreducible costs (in between the above costs). He defines irreducible costs as some form of opportunity costs which require different forms of modelling. He also mentions three broad categories of costs associated by IT projects. These include hardware and software costs, labour hours, support fees and other hard facts related to computer ownership:

- Technological costs
- system costs and
- support costs.

Riel argues that, in classifying the cost of the IT investment into the categories and forms above, a more comprehensive picture of the effects (short-term and long-term) can be gained to evaluate the IT investment decision.

The justification for IT implementation and deployment will be greatly enhanced by proper classification of possible IT systems. This will be done according to the information delivery software classification presented below.

3.1 CLASSIFICATION OF INFORMATION DELIVERY SYSTEMS

It is evident that IT has given organisations competitive parity. The history of IT has essentially been that of finding more efficient ways and means of getting data into systems to perform simple tasks (see Figure 18). Greater efficiency results in less waste, fewer resources and reduced costs. Also, by standardising and



integrating systems, more waste is eliminated. One possible disadvantage of this approach is that organisations all perform at the same level. Thus, standard approaches to IT may deliver short-term competitive advantages, but, in the long-term, may only ensure competitive parity. Moreover, standard approaches to IT may corrode differentiating strengths. In view of this, organisations should find ways to discover, develop and accentuate their strengths. The focus of future organisations will not be on collecting data, but rather on acquiring information (and business intelligence) to support and enhance innovation. Competitive advantage comes from matching internal strengths to profitable opportunities to create and sustain advantages that competitors cannot easily copy. For this, they need information about their own businesses, their customers and the external environment. The data that organisations collect over many years could act as the source of that information. This is the notion of 'information delivery'.

3.2 DEFINITION OF INFORMATION DELIVERY

Information delivery may be defined as the end-to-end process of converting raw data, which large organisations have in abundance, into meaningful information which is required to support and enhance successful decision-making [after The SAS Institute, 1999]. Such software may be categorised according to four main categories.

These are:

- ❑ Personal productivity tools and utilities,
- ❑ transactional databases,
- ❑ standard operational applications and
- ❑ information delivery.

The first three categories above are primarily concerned with data capturing, time saving and the achievement of day-to-day efficiencies. Personal productivity tools have automated the process of creating documents and organising personal



information. Transactional databases provide an efficient means of storing substantial amounts of data that is continually changing. Standard applications enable an organisation to integrate its operational processes based on common software. The first three software categories are essential to the organisation's survival and provides an operational solution. However, the last category concerns more than survival. It is essential only to those organisations that have set themselves more ambitious goals (such as market leadership, exceptional levels of customer satisfaction, above-average ROI and sustainable competitive advantage), hence a more strategic focus.

3.3 CLASSIFICATION OF INFORMATION DELIVERY SYSTEMS

One proposition in terms of the class of IT is presented by the following matrix representing the software landscape as four quadrants of the software industry and their respective leaders (examples are given in brackets in order of usage).



<p>SYSTEMS APPLICATIONS (OLTP – ESPECIALLY ERP)</p> <p>EXAMPLES: SAP AG, PEOPLESOFT, BAAN, JD EDWARDS, SSA</p>	<p>BUSINESS INTELLIGENCE (INFORMATION WAREHOUSING & MINING)</p> <p>EXAMPLES: SAS, HYPERION, COGNOS, BUSINESS OBJECTS</p>
<p>DATABASE APPLICATIONS</p> <p>EXAMPLES: ORACLE, EXCEL, SYBASE, INFORMIX, MS ACCESS, LOTUS NOTES, DBASE, SOFTWARE AG</p>	<p>OFFICE AUTOMATION</p> <p>EXAMPLES: E-MAIL, DESKTOP PUBLISHING, WORD PROCESSING, FACSIMILE TRANSMISSIONS, VIDEO CONFERENCING</p>

Figure 19: Proposed classification of information delivery systems in terms of cost and ease of implementation

Each quadrant of the software industry has a clear leader – MICROSOFT (personal productivity), ORACLE (transactional databases), SAP (standard transactional applications) and SAS (business intelligence). The most relevant of these will be discussed next, using the market leader in that quadrant as an example. It should be noted, however, that there is evidence that the products in the different quadrants of the matrix, are continuously improving and competing with those in other quadrants. The first and most basic level is that of office automation and, since it is felt that most organisations have already invested in these systems, they will not be discussed in this thesis. The other three quadrants will be discussed in the order in which this author believes them becoming pertinent to organisations and their growing need for strategic information (or business intelligence). Thus, it is this author’s contention that



organisations will move through these quadrants in the following order as a subsequent need for (strategic) information arises and corresponding to the evolution of IT in Figure 18:

Office automation → DB applications → Online transaction processing → Business intelligence.

(i) *Database management systems (DBMS):* A database (DB) is defined by Laudon and Laudon [1997: 203] as:

'...a collection of data organised to serve several applications efficiently by centralising the data and minimising redundant data.'

They add:

'Rather than storing data in separate files for each application, data are stored physically to appear to users as being stored in only one location.'

Consequently, a single DB services multiple applications.

Thus, these authors maintain that DBMS can be viewed as the software that:

- ❑ Permits an organisation to centralise data,
- ❑ manages them efficiently and
- ❑ provides access to the stored data via application programmes.

The DBMS acts as an interface between application programmes and the physical data files.

A multidimensional DB model represents relationships between data in a multidimensional structure. This principle is best viewed as cubes of data and cubes within cubes of data, with every side of the cube consisting of another level of information, in contrast to spreadsheet applications which consist of data of a flat nature. Thus a matrix of actual sales can be stacked on top of a matrix of



projected sales to form a cube with six faces. Cubes may be nested within cubes to build complex views of data. The DB environment is schematically presented below with the DBMS acting as an interface between the application programmes and the data.

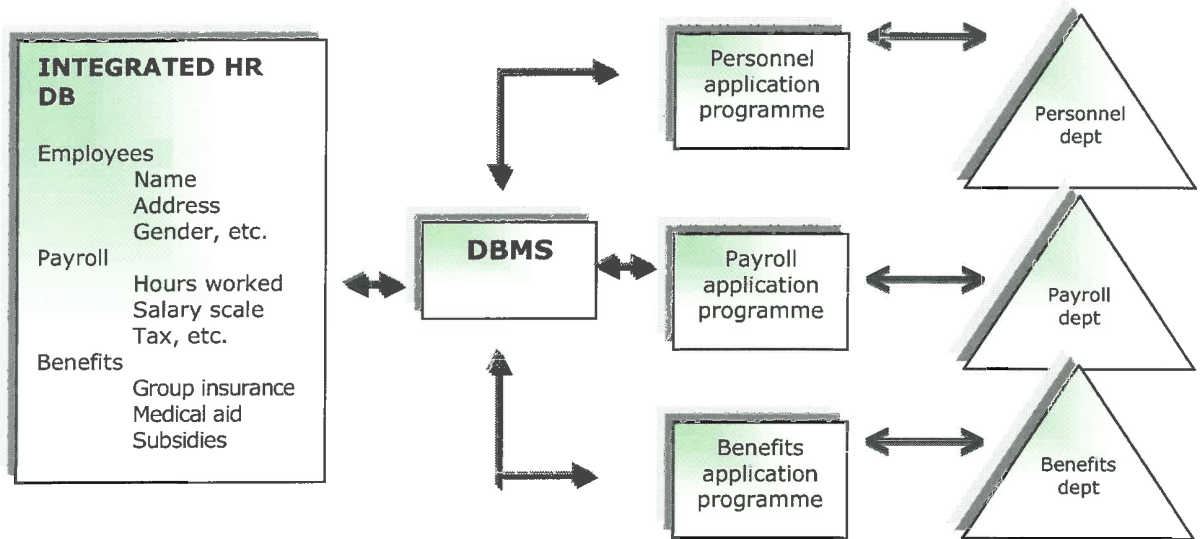


Figure 20: The DB environment
After: Laudon and Laudon, 1997

The main advantages of DBMS are summarised in the table below.



Table 17: Main advantages of DBMS

Reduction of the complexity of the IS environment	Through central management of data, access, utilisation and security
Reduction of data redundancy and security	Through the elimination of isolated files in which the same data elements are repeated (corresponding to the BPR principle of capturing data once, at the source)
Elimination of data confusion	Through the provision of central control of data creation and definitions
Reduction of programme-data dependence	Through the separation of the logical view of the data from its physical elements
Reduction of programme development and maintenance costs	
Higher flexibility of IS	Through rapid and ad hoc queries from large pools of information
Increased access and availability of information	

After: Haag, Cummings and Dawkins, 1998

- (ii) *Transaction software or standard applications:* The SAP system is currently the world’s biggest-selling Enterprise Resource Planning (ERP) system. ERP entails the development and implementation of a total (on-line) software solution. All aspects of business information are packaged within one integrated solution. The result is faster decision-making, since all information within the organisation’s IT/IS structures is assimilated and summarised within one system. This enhances organisational efficiencies, since they contain information about the organisation’s customer base, inventories (and inventory build-ups, etc.). This quadrant can also be classified as OLTP (or online transaction processing) consisting of a wider range of systems than the popular ERPs. This will not be covered in detail here.

The following are issues pertaining to the implementation of ERP systems:



Table 18: Organisational issues in the implementation of ERP systems

Costs	ERP implementation is very costly and consumes a large part of the IT budget
IT resources	There is a substantial need for IT resources during the ERP implementation and in terms of maintenance
Functionality	The decision should be made as to whether specific modules only or the complete system, will meet the organisation's requirements – general information or specific requirements have to be addressed
Data availability	Management information is generally based on multiple data sources (internal or external) – all of which have to be available
Information flows	Strategic information should be available throughout the organisation (on INTRANET) – the ERP system is required to provide such an information sharing and storage facility
No transactional facility	Transaction data should be stored separately since calculations are not the main function in a reporting environment
ERP systems are not open to other systems	SAP has a so-called family of add-ons that link onto their software and provide links from other platforms
No provision for data storage or information reporting	The core functionality of ERP is not that of information warehousing and ERPs have been found lacking in this area – although SAP AG is moving into the competitive field of information warehousing

The link between ERP systems and BPR will be addressed in the next Module.

(iii) *Information warehousing/mining (or business intelligence):*

Data/Information warehousing addresses the problem of fragmented data in separate operational systems, thus not allowing decision-makers to integrate complete knowledge bases. Laudon and Laudon [1997: 218] define a data warehouse (this author prefers the term *information warehouse*) as

'.. a database, with tools that stores current and historical data throughout the organisation.'



The data may originate in many core operational systems and are copied into the information warehouse when needed – striving towards a pull (or JIT) information delivery system. The data are standardised and consolidated to be used across the organisation for strategic analysis and decision-making. Thus, an information warehouse includes query and analytical tools as well as graphical reporting facilities. These systems may perform high-level analysis of trends, but are also able to drill down into more detail if so needed. They seek business intelligence. Thus information warehouse data may differ from operational data according to the platforms below.

Table 19: Different platforms for operational data and information warehousing

OPERATIONAL DATA	INFORMATION WAREHOUSE
Isolated data	Organisation wide integrated data collected from legacy systems
Contains current operational data	Contains recent data as well as historical data
Original fields may be inconsistent across the organisation	A single agreed upon definition exists for every field stored in the system
Data are organised from an operational or functional perspective	Data are organised around major business information subjects
Data are volatile to support operations within the organisation	Data are stabilised for decision-making
Data are stored on multiple platforms	Data are stored on a single platform

Information warehousing includes important organisational strategies, such as Executive IS (EIS), Management IS (MIS), Decision Support Systems (DSS), marketing and financial strategies.



The technological framework for information delivery is the information warehouse. An information warehouse is more than a store of data; it consists of an entire process of:

- Extracting data from operational systems,
- reconciling and organising it in ways that make business sense and
- exploiting it with knowledge discovery and analytical software.

Data mining is undoubtedly one of the fastest growing fields in the software delivery arena. Once a small interest area within Computer Science and Statistics, it has expanded into a field of its own, providing strategic benefit from data and information for long term decision-making. In broad terms the data mining process (from the data warehouse) tries to discover hidden patterns and trends, especially since:

- Databases become large and multi-dimensional, making access and analysis virtually impossible,
- standard statistical methods may be impractical because of missing values
- the large databases make it impossible for systems administrators to know what information is pertained in the data or what is relevant to ask.

Information delivery covers a range of technologies concerned with the end-to-end process of extracting information from raw data to support meaningful decisions. On the other hand, the practicalities of information delivery make it very difficult to implement solutions unless they are based on an 'end-to-end' approach to technology. In such an end-to-end approach, the same family of software solutions performs all the essential functions of information delivery. This quadrant may also be called *business intelligence*, or OLAP (On-line Architecture Platform) as this is what it provides to the business.

The main advantage of an end-to-end solution is the elimination of integration issues. Selecting different modules of an information delivery solution from various suppliers (called 'best-of-breed') may:



- ❑ Delay implementation
- ❑ cause vast expense,
- ❑ cause time consuming maintenance problems and
- ❑ build inflexibility into the system (counter to the notion of increased responsiveness and market edge).

An end-to-end solution, on the other hand, is designed for rapid ROI and sustainable competitive advantage.

It is evident that SAP AG is moving towards this market with the launch of their Datawarehouse module, as is ORACLE. The trends in the latter's product development are depicted in Figure 21 below (software competitors given in brackets). ORACLE's way of providing business intelligence takes the form of DSS applications modules indicated in the same figure.

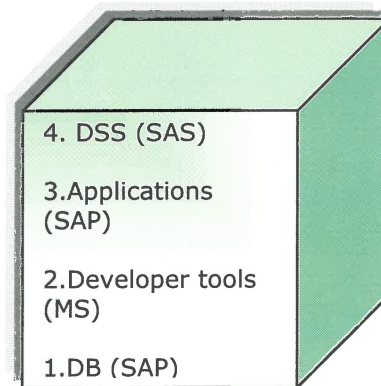


Figure 21: ORACLE's stacked system as example of trends towards business intelligence

In view of all this, it is contended that the new platform of competitive advantage will be in the domain of *business intelligence* and information delivery and that, as indicated by the matrix in Figure 19, information warehousing will play the major role in organisations and efforts to make successful business decisions.



One of the principal themes of this thesis is the linkage of the above packaged solutions and BPR. One of the primary concerns of BPR (see Module V) is the need to (re-)design systems and processes that fit the organisation and its needs. Selection criteria for packaged solutions hardly consider the extent to which such a fit may be retained. Thus the organisation no longer has total control over the systems design process. Even with the most flexible and easily customised package, there are limits to the amount of tailoring allowed. Organisations experienced in the use of packaged software solutions have noted that even the 'best' packages cannot be expected to meet more than 70% of the organisation's requirements [Laudon and Laudon, 1997]. These will have to remain unmet by the organisation or be satisfied by some other means. If the package cannot adapt to the organisation, the organisation will have to adapt to the package and change its procedures – that is, engage in secondary re-engineering. One of the most far-reaching impacts of software packaging is their potential effect on organisational procedures. The kind of information and business intelligence an organisation may store and retrieve for an application such as accounts receivable, could largely be determined by the applicable package.

4. RE-ENGINEERING THE WAYS OF DOING BUSINESS THROUGH IT - DIGITAL COMMERCE

Modern trends towards a virtual workplace and telecommuting focus on the use of communications technology (for instance, fax, voice-mail, video conferencing) to allow people to perform related tasks even from dispersed locations anywhere in the world. The success of the virtual workplace and telecommuting depends upon the organisation's ability to do business electronically. This emerging practice is known as digital (or e-) commerce.



4.1 DEFINITION OF DIGITAL COMMERCE

According to Haag, Cummings and Dawkins [1998: 15], electronic commerce may be defined as follows:

' Electronic commerce is a methodology that addresses the use of IT as an enabler of business. Electronic business supports both internal and external business functions.

That is, external electronic commerce addresses the use of IT to support how a business interacts with the marketplace, and internal electronic commerce addresses the use of IT to support the internal processes, functions and operations.'

This definition encompasses two related IT themes. These are:

- *IT as an external support function:* IT in support of how a business interacts with the marketplace, and
- *IT as an internal support function:* IT in support of internal processes, functions and operations – including BPR.

In business, digital commerce includes:

- Performing transactions with customers over the Internet for purposes such as home shopping, home banking and electronic cash use.
- Performing transactions with other organisations through the use of Electronic Data interchange (EDI), that is, the direct computer-to-computer transfer of transaction information contained in standard business documents, such as invoices and orders.
- Gathering information relating to consumer market research and competitors (competitor scanning).
- Distributing information to prospective customers through interactive advertising, sales and marketing efforts.



It is believed that the future success of businesses will depend on their ability to:

- Use EDI to re-engineer inter-organisational business processes.
- Perform functions in the electronic marketplace, such as finding customers and suppliers.
- Internalise EDI to support the virtual workplace.

4.2 APPLICATION OF DIGITAL COMMERCE

Digital commerce gets rid of research documents in the distribution of information, for instance, on sales and purchase orders. It creates strategic outsourcing alliances, forms electronic partnerships with other organisations and reaches large numbers of potential clients through the Internet. Amazon.com and eBay are perhaps the biggest virtual organisations in the world today.

The application of digital commerce has the following advantages:

- Decreased administrative and operational costs,
- decreased requisition cycle time and administrative bureaucracy,
- decreased transactional costs,
- increased control over and communication with preferred suppliers, which may entail (also refer to Figure 19 for the different information delivery systems):
 - negotiating better volume discounts,
 - providing employee/customer self service,
 - automating routine/approval process (along JIT principles),
 - real time product and inventory information;
- full integration with overall IS of the business,
- integration with the on-line business systems (this business and between businesses) the more so if different organisations employ the same or compatible information delivery systems,
- specifically, business-to-business data interchange over the Internet (HUB and SPOKES):
 - enhanced data transport and data format,



- interoperability/cross platform capabilities (examples: ORACLE 7.3 and Siemens Nixdorf).

5. CRAFTING AND CREATING COMPETITIVE ADVANTAGE THROUGH IT

There is widespread acceptance that IT and IS have transcended the traditional administrative, back-room support orientation towards a more strategic central role within the organisation. In the subsequent sections, models illuminating the strategic relevance and importance of IT are discussed.

The main models are:

- ❑ The Strategic Grid and
- ❑ the Strategic Alignment Model.

5.1 THE STRATEGIC GRID

With reference to Module V which will explore the functionalities of BPR and the relevance of IT in these endeavours, it is fitting here to explore Davenport's five-step framework for implementing BPR [Davenport, 1993]. He suggests that one must:

1. Identify processes for innovation.
2. Identify change levers.
3. Develop process visions.
4. Understand existing processes.
5. Design and prototype the new process.

He enumerates the following key activities with regard to the first step in the above framework:



- Enumerate major processes.
- Determine the process boundaries.
- Assess the strategic relevance of each process.
- Render high-level judgements on the health of each process.
- Qualify the culture and politics of each process.

In assessing strategic relevance and in qualifying culture, the Strategic Grid Analysis is important. This presents a well accepted planning tool for assessing the value of a particular organisational element to the strategic direction of the organisation. Cash et al [1993] applied the Strategic Grid to IS projects and labelled it the IT Strategic Grid. The axes of the IT Strategic Grid portray the current (= y-axis) and future (= x-axis) strategic importance of IS activities in the organisation. Four quadrants are identified: *strategic*, *turnaround*, *factory* and *support*. These are depicted in the following scheme.

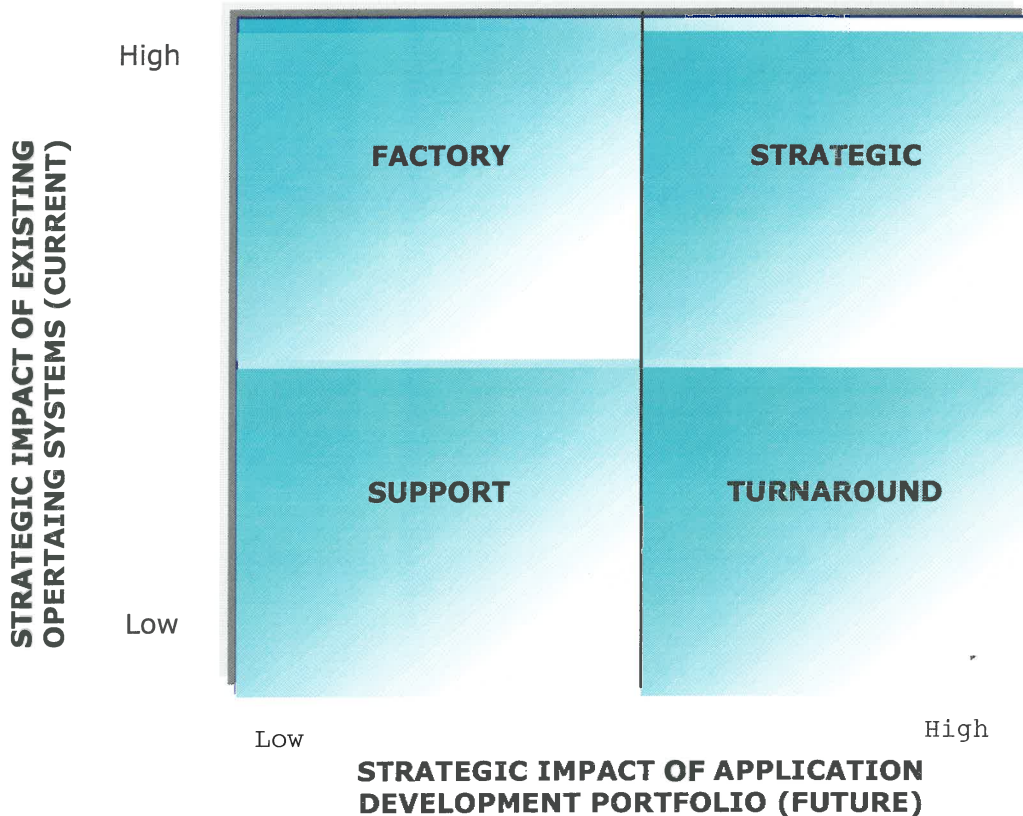


Figure 22: (IT) Strategic Grid Model
Source: Revenaugh, 1994

In respect of the quadrants in the above Grid, the following may be noted:

- (i) *Strategic quadrant:* Organisations in this quadrant are critically dependent on the smooth functioning of the IS activity for both their current and future needs. Strong IS planning is essential and should be closely integrated with corporate planning. The impact of IS on organisational performance is such that there should be significant top management attention and guidance in the IS planning process.



- (ii) *Turnaround quadrant:* Organisations in this quadrant are not critically dependent upon IS applications for their current operations, but applications under development, are expected to play a vital role in the organisation's future. As is the case with organisations in the strategic quadrant, turnaround organisations should have significant top management involvement in their planning process. Since turnaround organisations are not used to this type of involvement, other changes should occur to enhance senior management's understanding and overview of IS.
- (iii) *Factory cell:* Organisations in the factory cell are critically dependent upon existing IT support systems. However, applications under development are not crucial to the organisation's ability to compete successfully. Strategic IS planning and linkage to long-term corporate plans are not nearly as critical in this environment. IS planning should continue to take place with guidance as to where the organisation is going, but, senior management involvement in the planning process is commensurately far less.
- (iv) *Support cell organisations:* These organisations are in the low quadrant of the grid, suggesting that they would place the minimum emphasis on IS and IS planning in terms of top management concern and involvement.

The four IS/IT environments delineated by the Strategic Grid framework suggest that each environment requires a different information management approach. IS is of significant importance in some organisations, but to a lesser extent in others. It should be noted, however, that, since the inception of the Grid in 1993 by Cash **et al**, the use of and need for, IS/IT has dramatically increased and it would be unwise (in fact, unlikely) for organisations to remain competitive by maintaining a 'support cell' IS culture.

The relevance of the IT Strategic Grid will become more evident in Module V in which the link with BPR is discussed.



5.2 THE STRATEGIC ALIGNMENT MODEL

The *Continuous Strategic Alignment Model* will be discussed as an analytical and administrative approach to conceptualise and manage the emerging nexus. The implications of the IT evolution revolve around the potential not only to support chosen business strategies, but to shape new business strategies [Henderson and Venkatraman, 1993].

However, the following are real areas for concern:

- ❑ The anticipated value of the (sometimes huge) IT investment is not achieved.
- ❑ There is evidence of minimal productivity gains at an aggregate level of the economy.
- ❑ There is increased evidence of IT outsourcing.

It is argued that the inability to realise value from IT investments is largely due to the lack of alignment between the business and IT strategies. Furthermore, it is asserted that the organisation's ability to use IT functionality as a lever to obtain differential advantage in the marketplace requires a dynamic administrative process to ensure continuous alignment between the business and IT domains.

Examples of South African organisations which have successfully used the leverage of IT capabilities to shape and support their business strategies include: The newly deployed computerised system for the South African Internal Revenue Department, Medical aid schemes that employ intelligent systems to detect exploitation of patients and also EDI for easier and faster information transfer to and from the practitioner.

The concept of the Continuous Strategic Alignment Model is based upon two building blocks:

- ❑ Strategic fit (or alignment) and
- ❑ functional (or administrative) integration.

Neither of the above components is sufficient in isolation and both are required to create and sustain the dynamic link between business and IT domains. This is depicted in Figure 23 below.

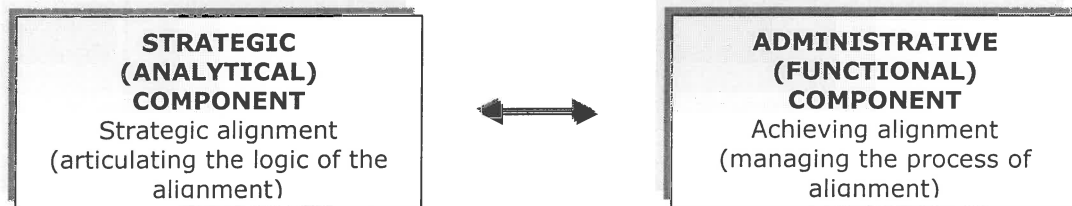


Figure 23: The two components of continuous strategic alignment
Henderson and Venkatraman, 1993: 140

(i) *The strategic fit* recognises the need for any strategy to address both external and internal domains. The external domain is the business arena in which the organisation competes and is concerned with decisions such as product-market offering and the distinctive strategy attributes that differentiate the organisation from its competitors, as well as the range of 'make/buy' decisions, including partnerships and alliances. The internal domain is concerned with choices pertaining to the logic of the administrative structure and the specific rationale for the design and redesign of critical business processes (product delivery, product development, customer service and total quality). The internal domain is also concerned with the acquisition and development of the human resource skills necessary for achieving the required organisational competencies.

Within the business domain, it has been argued that the fit between the external and internal positioning is of critical importance for maximising economic performance. This is also true for the IT domain. It is contended that the IT strategy should be articulated in terms of an *external* domain (that is, how the organisation is positioned in the IT marketplace) and an *internal* domain (how the IS infrastructure should be configured and managed).

The Strategic Alignment Model is shown in Figure 24 below and summarises four dominant alignment perspectives – each representing a triangle of three concepts

covering both business and IT domains, as well as internal and external domains. Each perspective is unique in terms of the driving force (business or IT strategy) and represents distinct and mutually exclusive management implications.

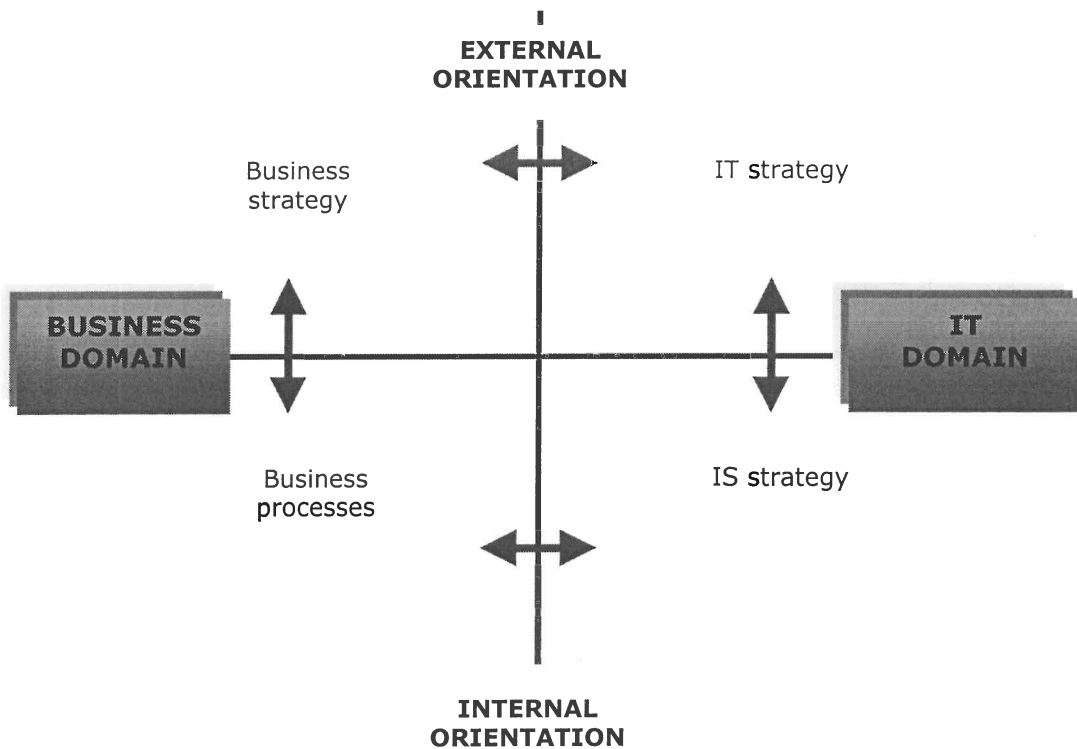


Figure 24: The Strategic Alignment Model
Source: Henderson and Venkatraman, 1993

The four dominant alignment perspectives according to the cross-domain relationships are:

- Business strategy (strategic) and organisational infrastructure (operational) representing the *business domain* as driving force.
- IT strategy (strategic) and IT infrastructure and processes (operational) representing the *IT domain* as the driving force to achieve new or enhanced business.

Then, according to Henderson and Venkatraman [1993], the link between business strategy and IT strategy reflects the capability to use IT strategy as a



lever to both shape and support business strategy. Correspondingly, the link between organisational infrastructure and processes, and IT infrastructure and processes, reflects the need to ensure internal coherence between the organisational requirements and expectations and the delivery capability within the IS function.

These perspectives are expanded upon below.

Perspective 1 - Strategy execution:

This perspective reflects the notion that the business strategy is the driving force behind both organisational design choices and the logic of the IS infrastructure. It is arguably the most common and widely understood alignment perspective as it corresponds to the classic, hierarchical view of strategic management. Consequently, there are various analytical methodologies available to operationalise this perspective (for example 'Enterprise Modelling', and 'Business Systems planning', [Martin, 1995]). Top management should act as a strategy formulator, while IS management should act as the strategy implementor in order to efficiently and effectively articulate the required IS support for the particular business strategy. The performance criteria will involve financial parameters reflecting a cost centre focus.

Perspective 2 - Technological potential:

This alignment perspective involves the articulation of IT strategy to support the chosen business strategy and the corresponding specification of the required IS infrastructure and processes. In contrast to the strategy execution logic, this perspective is not constrained by current organisational design. Rather, it seeks to identify the best possible IT competencies through appropriate positioning in the IT market environment, as well as the identification of the corresponding IS architecture. For this



alignment to succeed, top management should provide the technology vision to articulate the logic and choices pertaining to IT strategy that would best support the chosen business strategy, with the role of the IS manager being that of technology architect – who efficiently and effectively designs and implements the required IS infrastructure that is consistent with the external component of IT strategy (scope, competencies and governance). The performance criterion is based upon technology leadership with qualitative but insightful benchmarking along a set path of critical measures pertaining to the positioning in the IT marketplace.

Perspective 3 - Competitive potential:

This alignment perspective is concerned with the exploitation of emerging IT capabilities to impact upon new products and services (the business scope), influence the key attributes of strategy (distinctive competencies) as well as develop new forms of relationships (business governance). Unlike the previous two perspectives which considered business strategy as a given (or a constraint in terms of organisational transformation), this perspective allows modification of business strategy through emerging IT capabilities. Beginning with the three dimensions of IT strategy, this perspective seeks to identify the best set of strategic options for business strategy and the corresponding set of decisions pertaining to organisational infrastructure and processes. Top management's role is to make the perspective succeed; it is that of visionary, articulating how the emerging IT competencies and functionalities as well as changing governance patterns in the IT environment would impact on the business strategy. In contrast, the role of the IS manager is one of catalyst, interpreting and identifying trends in IT to assist managers to understand the potential opportunities and threats from an IT perspective. The performance criteria are based upon business leadership with qualitative and



quantitative measurements pertaining to product leadership (market share, growth and new product introduction).

Perspective 4 - Service level:

This alignment perspective focuses on how to build a world class IT/IS organisation within an organisation. This requires the articulation of the external dimensions of IT strategy with corresponding internal logic for the IS infrastructure and processes, with appropriate implications for the organisational infrastructure and processes. Business strategy plays an indirect role. This perspective is often viewed as necessary (but not sufficient) to ensure the effective use of IT resources and be responsive to the growing and rapidly changing demands of the end user population. Analytical methods require a systematic analysis of IT markets and also of the possible service contracting approaches. Top management's role is that of prioritiser, articulating optimal allocation of scarce resources both within the organisation and in the IT environment (for instance, joint ventures, licensing and minority investments). The IS manager's role is that of business leadership, with specific tasks of making the internal business succeed within the operating guidelines from top management. The performance criteria are based upon customer satisfaction with qualitative and quantitative measurements with internal and external benchmarking.

(ii) *Functional fit:* As can be seen from Figure 23, the second component of the continuous strategic alignment model deals with the management challenge of translating the strategic decisions, according to the above perspectives, into operational practicalities. This is similar to the four phases of re-engineering (namely analysis, design, transformation and evaluation), with much time and effort allocated to the analysis and design phases, but the transformation and implementation phase lacking in energy. This execution component should be done according to the following mechanisms for administrative achievement of alignment. These mechanisms are [Venkatraman, Henderson and Oldach, 1993]:

- ❑ *Governance process* – dealing with the policies, procedures and systems for allocating decision rights to key decision-makers,
- ❑ *Technological capability* – dealing with the administrative process for creating the required IT capability for supporting and shaping the business strategy,
- ❑ *Human capability* – dealing with the administrative process of creating the required human skills and capability for supporting and shaping the business strategy, and
- ❑ *Value management* – dealing with those actions taken to establish means to select IT investments, define a performance management system that will maximise the likelihood of these investments to attain their goals and learn how to adapt this performance measurement over time.

These are summarised in the scheme below.

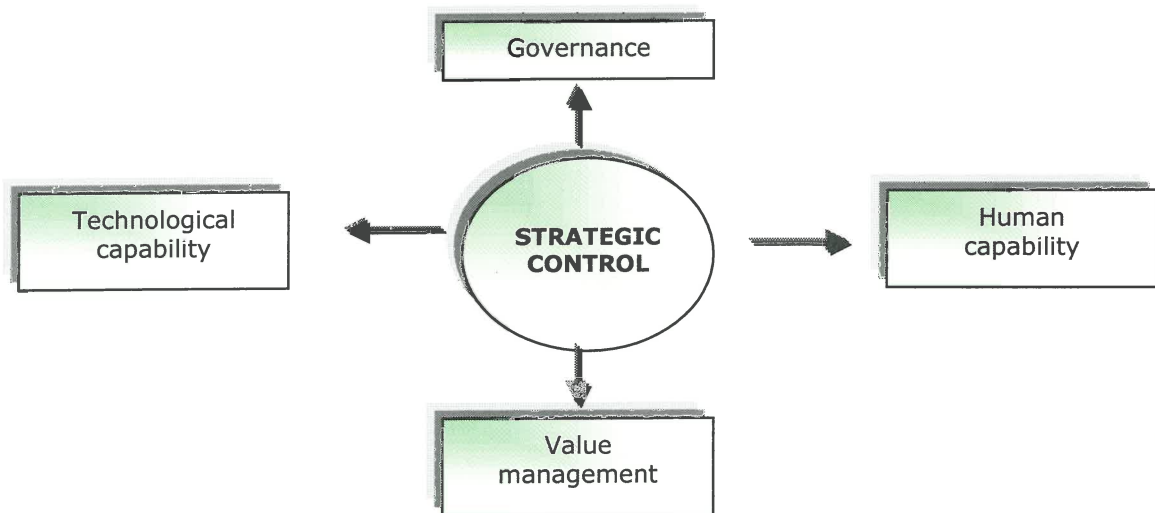


Figure 25: Summary of the four administrative functions needed to support the IT alignment strategy

After: Venkatraman, Henderson and Oldach, 1993

Following on earlier discussions in this module, and since the effect of and the evaluation of the IT investment will be studied in the next Module, the above issue of value management needs attention. According to Venkatraman,



Henderson and Oldach [1993], value management comprises of three interrelated activities.

These are:

- Investment decisions,
- performance management and
- evaluation.

These will be expanded upon below.

- (i) *Investment decisions:* IT investments traditionally fall within the domain of capital budgeting, with the potential IT impacts described as a measure of productivity. However, IT does not generally use productivity as leverage in the short-term (the so-called productivity paradox), and thus there is widespread dissatisfaction with this view of value management. As IT impacts upon the reshaping of the work environment (BPR), the productivity/financial orientation of most capital budgeting processes proves too limited in scope to handle either the true value of the investment or to adequately represent the risks (radical change) associated with the investment. While the technical component of risk may be recognised (that is, the risk that the system may not deliver the required technical features), the true risk associated with the radical change is generally underestimated.

The value of many capital investments is associated with the future flexibility provided by the resulting infrastructure. Traditional capital budgeting will systematically undervalue this opportunity to create future options. Moreover, application of the NPV approach to IT investments tends to further obscure the true risks of the IT investments, since it generally results in a single-point investment decision, rather than the multi-phased process required to manage both the risks and opportunities associated with an options-creating investment.



These have been discussed within the TCO and ROIT context in Section 2.4.

- (ii) *Performance measurement:* Deals with the design of a measurement system that will be used to guide the operational activities with the emphasis on the logic of the design. Within the application of Total Quality Management (TQM), the involvement of leadership is critical in the design of an appropriate measurement to ensure that the IT investment achieves the desired benefits.
- (iii) *Evaluation:* This is deemed different from the traditional technological audit, in the sense that evaluation should be considered from the initiation phase of any project to maximise potential benefits and organisational learning.

In conclusion, one may ask which alignment perspective is preferable. The answer is that no single universally superior model to formulate and implement strategy, exists. If the converse had been true, strategy would have been meaningless. All four alignment strategies are equally useful and powerful in the application of IT as a transformation tool. Leadership is urged not to deem the role of IT a panacea and consequently focus only on those two perspectives with IT strategy as the starting point (namely, business transformation and service level); nor should the business strategy be the starting focus. The potential of IT is so varied, the landscape so broad and complex, that all perspectives should be considered before the institutionalisation of the appropriate set of alignment mechanisms.

6. CONCLUSION

Until recently, organisations have had to balance the cost of sending data (or information) by tailoring the amount, timeliness, speed and interactivity of the information exchange to economic realities. A fundamental shift in the cost of information and of information delivery is removing the trade-off between



audience size and richness of information. New ways of communicating (information) are making it economical and easier to send high volume, quick, multimedia, customised and interactive information across the globe. This fundamental shift in information economics will cause two changes in organisations:

- Fragmentation of different operations within the organisation into separate businesses and
- Consolidation of organisations that perform the same functions.

In the light of the subsequent Module V on *de-engineering the organisation*, and, since the above simultaneously conflicts with and agrees with the objectives of re-engineering, the above issues will be addressed in these concluding remarks.

- (i) *Fragmenting the operations of the organisation:* In delivering various services for its customers, the organisation depends upon the exchange of information among its units or departments – part of the value chain. Economical transfer of information between an organisation and its external service providers could enable organisations to farm out various operations and tailor them to be highly efficient, thus fragmenting the organisation. An example of this is to be found in banking where a person with a checking account, mortgage, consumer loan, credit card, savings account or certificates of deposit traditionally dealt with an employee who knew the customer and all his accounts. In the fragmentation scenario, different organisations perform specialised roles for banks. For each account, the customer could be serviced by a different organisation that handles processes like on-line chequeless banking and electronic transfer (refer to the section on Digital Commerce and the section in Module III on new organisational structures). Every business could be skilled in a different aspect of the banking environment. For instance, one might specialise in mortgages, the other in investments and another in presentation and acceptance of payments. The service from the separate specialists is better and less expensive than if the banks performed these tasks themselves. However, the bank still has the primary relationship



with the consumer and still has information about the consumer and can focus on service. This is the typical 'virtual organisation' model.

- (ii) *Horizontal consolidation of service organisations:* The spotlight shifts to the following question:

Once organisational operations are fragmented into horizontal businesses serving many organisations, how many organisations are needed to perform the different functions?

The new economics of information enables organisations to remain in charge of (even pre-empt) each request and respond to it efficiently and effectively. It builds on the principles of relationship and retention marketing so valuable from a strategic organisational point of view. An example of this may be found in banking where the bank becomes the parent for all contractors it hires and provides the connection with the consumer. If these contractors are significantly efficient on a large geographical basis, yet retain the customised, tailored service, not many are needed. If the customer opts to go outside the bank for electronic bank services, the bank's physical existence could be threatened.

The exchange of information has been the basis of transactions and interactions between and within organisations and between the organisation and its customer base (suppliers or consumers). The radical change in terms of the availability, economics and transfer of information has changed the paradigm of business. The consequences are new ways of doing business. Within the expanding service industry, information and knowledge are increasing as a commodity of commercial value. Moreover, the information content of all products sold in society is growing, with more money being spent on its acquisition.

IT management should examine where the economics and value of information may impact upon the organisation. In this regard, leadership should ensure that the organisation's IT structures and investments are aligned with its overall objectives and goals. (These strategies were explored in the last part of this module).