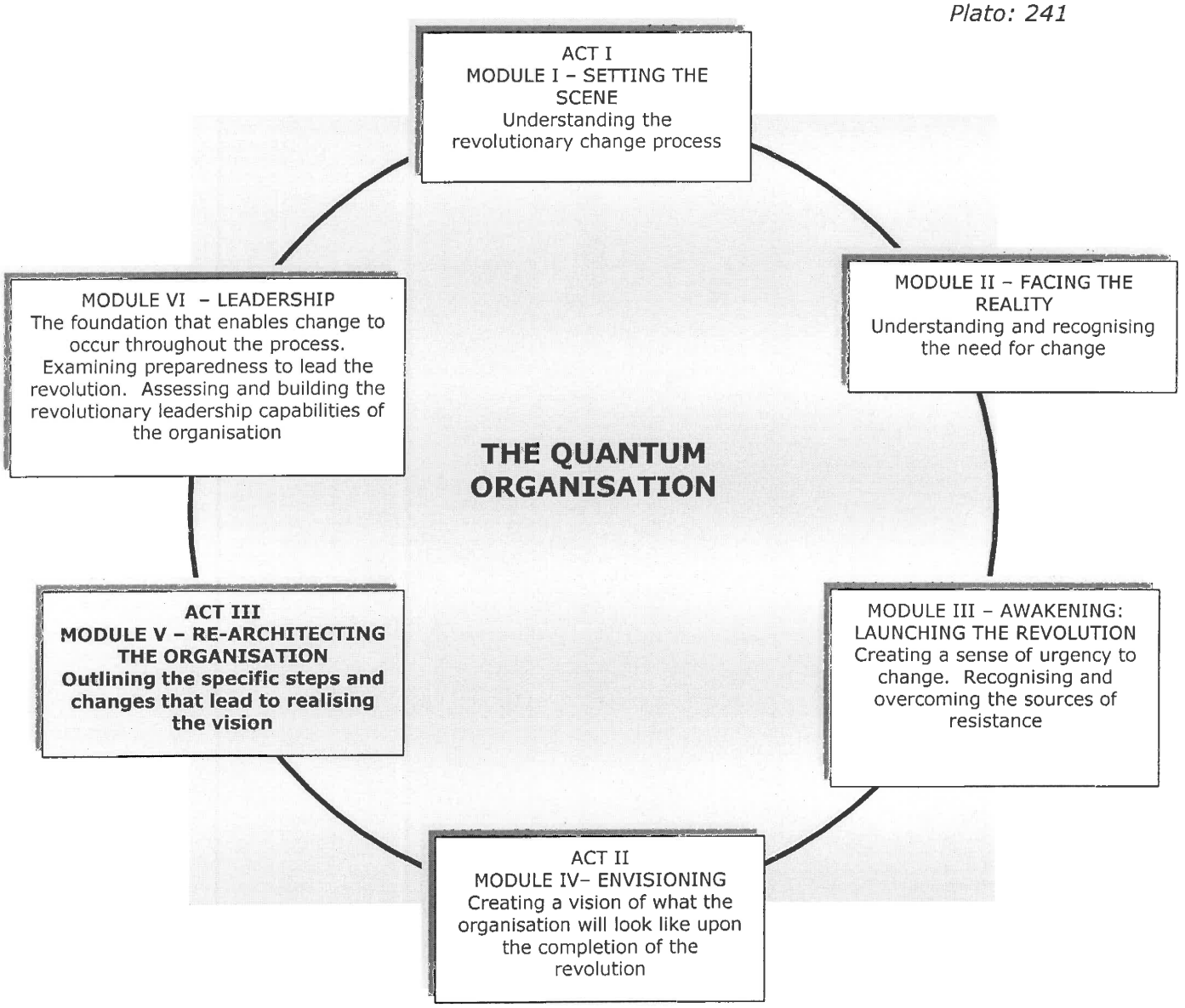
ACT III

INSTITUTIONALISING THE CHANGE

MODULE V – RE-ARCHITECTING: THE CASE FOR DE-ENGINEERING THE CORPORATION

'It is therefore our task, I continued, to constrain the noblest characters in our colony to arrive at that science which we formerly pronounced the highest, and to set eyes upon the good, and to mount that ascent we spoke of; and, when they have mounted and looked long enough, we must take care to refuse them that liberty which is at present permitted them .. The liberty of staying where they are, and refusing to descend again to those prisoner, or partake of their toils and honours, be they mean or be they exalted.'

Plato: 241



MODULE OBJECTIVES

In instituting the change, the module firstly explores the evolution of the modern management model and the role of Scientific Management. It subsequently studies the notion of strategic change and suggests possible change models in achieving the change.

Hammer and Champy's revolutionary terminologies used in defining their notion of BPR are compared to Marx's revolutionary doctrines as a means of explaining BPR's failures. Also, Hammer and Champy's definition of BPR is criticised and a more viable alternative formulation proposed.

It investigates business re-engineering – its advantages and disadvantages. The reasons for re-engineering as well as IT's role in achieving this, known as 'implicit technologism', are identified. It proposes a Technology Change Model, linking technology (existing or new) to the scope of change (incremental or radical). Multiple IT models are evaluated in terms of their relevance to BPR.

In conclusion, the clean-up after re-engineering (so-called de-engineering or chaos engineering) is proposed following re-engineering's failures to deliver on its promises. The de-engineering follows from the principles of chaos theory (especially the self-organising principle and correspondence) from Module II.

1. THE EVOLUTION OF THE MODERN MANAGEMENT MODEL

The twentieth century has seen the emergence of a number of management models. New models emerge with changes in values and norms in society at large. Their emergence is the result of the interaction between the social, political and technical forces present at any given time. Broadly speaking, the models reflect the general beliefs or general ways of thinking about certain phenomena. Four management models are of interest and are presented in chronological order although they do not function in isolation, but within each other [Quinn, Faerman, Thompson and McGrath, 1990].

MODEL 1: THE RATIONAL GOAL MODEL

The first part of this century saw enormous growth which ended in great prosperity - what is today generally referred to as the 'roaring 'twenties'. Technologically, this was the time for innovation and invention in both industry and agriculture. Values formed around the contentions of social Darwinism.

This period saw the rise of Frederick W. Taylor as father of Scientific Management. Based on his experience working with men in foundries and mills doing hard physical labour, his principles of management (first published in 1911) introduced a variety of techniques rationalising the production process and making it as efficient as possible. This style served the first half of the century well. Strategic planning focused entirely on the product.

The following are Taylor's four principles of management [Quinn **et al.,** 1990: 4]:

1. *Develop a science for every job, replacing the old rule-of-thumb method.*
2. *Systematically select workers to fit the job. Train them effectively.*
3. *Offer incentives in accordance with the principles of the science developed.*
4. *Support workers by carefully planning their work.*

The Rational Goal Model epitomises organisational effectiveness in terms of productivity and profit - the basic belief being that clear direction leads to productive outcomes. The emphasis is thus on goal clarification, rational analysis and action. The 'bottom line' is goal achievement and profit maximisation. The model is symbolised by the dollar sign. The manager's job is that of *director* and *producer*.

MODEL 2: THE INTERNAL PROCESS MODEL

This model is symbolised by the pyramid indicating a very hierarchical organisational structure. Effectiveness is measured by stability and continuity and there is great emphasis on processes such as definition of responsibilities, measurement, documentation and record keeping. The ultimate value is on efficient work-flow and the manager's job is that of *monitor* and *co-ordinator*.

MODEL 3: THE HUMAN RELATIONS MODEL

Fifty years after the introduction of Scientific Management, Elton Mayo [1880 – 1949] replaced this concept with the Human Relations Model. Although the first two models were still in place, these proved ineffective for the increased technological advances that took place. During the second quarter of the century, society underwent fundamental changes. The two events that dominated this era were the stock market crash of 1929 and World War II [1939-1945]. This era saw the advent of the union as a major economic force, as well as heavier emphasis on industry and the production of consumer goods.

Mayo and Fritz Roethlisberger carried out the famous Hawthorne studies on increased productivity, which shed light on the power of relationships and informal processes in performance.

The emerging model had core values of commitment, cohesion and morale. It introduced the means-end theory according to which involvement results in commitment. The model is characterised by participation, conflict resolution and consensus building and is thus symbolised by a circle. A clan-like, team-oriented

culture exists. The manager is involved in the development and motivation of employees. His job is thus that of *mentor* and *facilitator*. Unlike the first two models which complemented each other, this model runs counter to its predecessors, because it focuses on the people not the output.

MODEL 4: THE OPEN SYSTEMS MODEL

The early 'fifties saw the United States as the undisputed leader of the capitalist world. Then followed the oil embargo and Japanese superiority in product quality. This introduced a shift to a service-oriented economy. On top of that, technology advanced exponentially. These events triggered dramatic shifts in conventional values. Workers progressed from concern not only with monetary reward but also with self-fulfilment. Management concepts like group dynamics, management by objectives, organisational development and participative management flourished.

In this model the organisation is part of a competitive environment. Key areas of organisational effectiveness include flexibility, external support and responsiveness, and could well be symbolised by the amoebae (a very responsive, fast-changing organism). There is continual adaptation and innovation, leading to acquisition and maintenance of the external resources. The organisational culture is one of innovation and 'adhocracy' more than bureaucracy. The organisation exists within an environment of high risk. There is a common vision and shared values. The manager is seen as an adaptable *innovator* and *broker*, the latter in the sense that he uses power and influence in the organisation.

The above reflections on leadership will be further explored in Module VI.

1.1 THE ADVENT OF A DIFFERENT BUSINESS ORDER

Taylor's work on Scientific Management, based on his experience working with men in the mills and foundries, doing hard, physical labour, served the production

lines of the first half of the century [Bruce, 1993]. At the base of the Scientific Management movement and that of its more modern successors (for instance, organisation, methods and work study), lies the element of machine design [Hendry, 1995]. These approaches involve designing the work processes of the people as if designing a machine - people as machine parts or sub components. The objective is to define the most efficient machine for the purposes of the particular operation. This involves careful and scientific sequencing and arrangement of the tasks and precise specification and engineering of each task so as to eliminate potential sources of variance. A fundamental principle of Taylorism is that responsibility for the organisation of work lies with management (or the engineer of the machine system), not with the worker. For the worker to be an effective machine-person, the task should leave no scope for human intervention or choice.

The Western corporation has been greatly influenced by the military model: After World War II, America's fighting men traded in their uniforms for pinstriped suits. Enlisted men joined the assembly line. The same hierarchical structure, built on authority, remained in place.

Modern-day workers, however, are no longer passive; they have become thinkers and problem-solvers and their creative ability has become the major factor in their new participative role in the workplace. There is a new era of human freedom and responsibility and the modern manager must become a *teacher, facilitator and coach* [Kline and Saunders, 1993]. With the advent of the Information Age, jobs have become physically less demanding. Advances in computer technology are resulting in more flexible working conditions and task-oriented jobs, greatly reducing work/family conflict. Furthermore, the old hierarchies are being usurped by the sixties' generation who were influenced by ideals of equality and opportunity - with important ramifications in business culture [Bruce, 1993: 48]. There is a new dynamic of *shared power, teamwork, flat organisational structure and peer review* [Klempa, 1995]. (Refer to Module III, Section 3.2.)

1.2 THE 'AND/OR' MODEL: THE COMPETING VALUES FRAMEWORK

According to Quinn **et al.,** [1990: 11–13], the four models described above should not be seen as competing but as *complementary* within a larger integrated framework. They should be viewed as closely related and interwoven. Taken together in the so-called Competing Values Framework [Quinn, 1990], they provide the full complement of managerial perspectives necessary in the new future (see Figure 26).

In today's turbulent times, no leader can rely on competencies within one of the models alone, but has to be able to operate within all four levels suggested. The Competing Values Framework suggests a multiple mindset in order to integrate today's dynamic world order. It is suggested that the characteristics of the chaordic enterprise studied in Module III, serves this model. What remains to be determined, is how this business framework is to be attained – one solution being to re-engineer the business and/or its processes. Following on this, de-engineering will be introduced to address and resolve failures in re-engineering and its expectations.

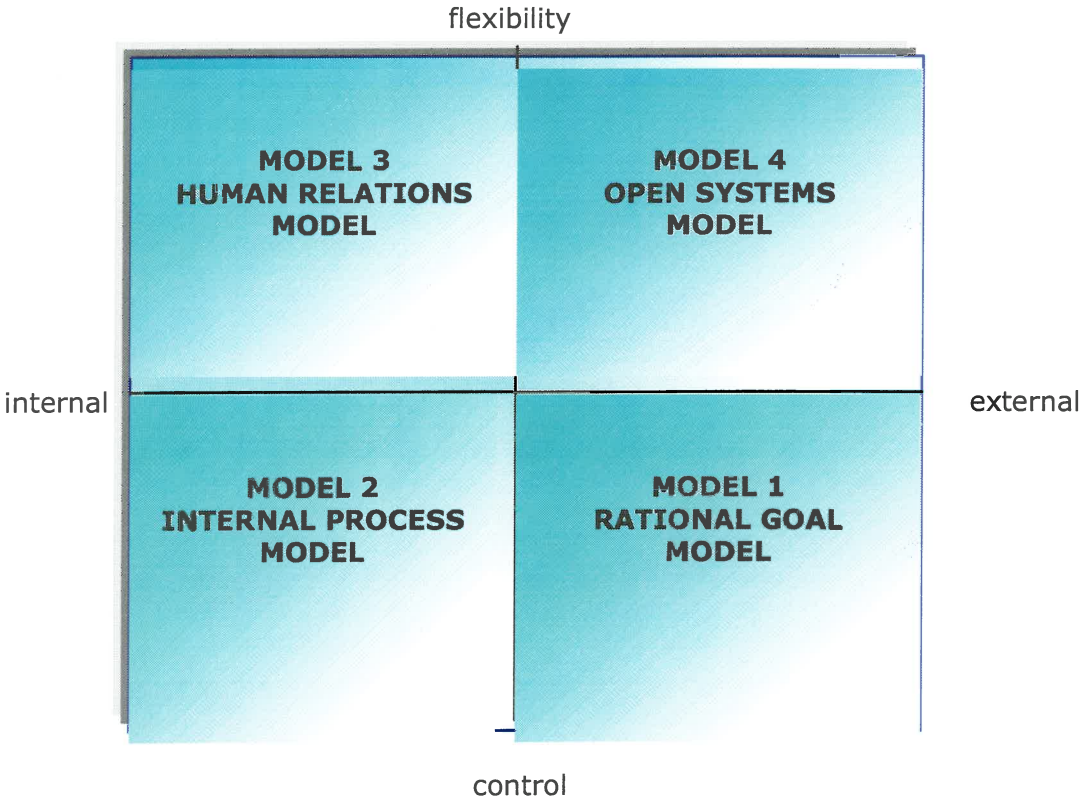


Figure 26: Integration of the four models into one Competing Values Framework
Source: Quinn ***et al.,*** *1993: 12*

The Competing Values Framework identifies some of the values and criteria of effectiveness (strategic fit) needed in organisations today. In the Competing Values Framework, the vertical axis in the matrix ranges from high *flexibility* at the top to high certainty or *predictability* at the lower end. The horizontal axis ranges from an *internal* perspective (on the left) to an *external* perspective (on the right).

This notion will be discussed in Module VI in terms of chaordic leadership. (Refer to Figure 42.)

2. TRANSFORMING THE SWAMP

'Organisations should develop the mental space
for new ideas to emerge and reframe
their assumptions about what it means to be strategic.'

So urge Hamel and Prahalad [1994: 187]. Building on the work done by Senge [1990] and other New Age strategists, they advocate that companies should build the 'forgetting organisation' (indicating a possible clean sheet re-engineering approach) and create the concept of a *toxic culture,* before they can build the '*learning organisation*'.

The title of this section refers to Covey's article [1993] by the same name in which he discusses the transformation of any bad workplace situation (swamp) into a lovely oasis by consciously moving out of the swamp. This, he maintains, entails a total paradigm shift to new principles or values. This section serves as a reminder that the mind-shift should be total and that the jump should be discontinuous as described in Module II, Section 4 – the focus here is *how* this is orchestrated.

2.1 ORGANISATIONAL LEARNING

The learning process should have one specific goal in mind, that is the creation of a very specific vision of what the organisation's future should look like. Hamel and Prahalad warn that many senior managers suffer from a kind of industry inbreeding that eventually results in short-sightedness with regard to competitive challenges on the horizon. The probable cause of this is that they all absorb the *same* values, perspectives, assumptions and beliefs about their businesses and industries. Over time, training and other mentoring programmes encode fixed management perspectives into the company. This imposes a lack of *genetic diversity* upon the management structures which even reaches down into the wells of racially and ethnically diverse companies. In fact, these authors maintain

that the advantages of cultural diversity are superseded by these genetic similarities.

Creating and crafting the learning organisation is a *journey,* not a destination [Burdett, 1993]. The concept of organisational learning and renewal as a *discontinuous* journey is an invaluable perspective in that it reiterates the idea of the *change process necessitating movement from unfreezing from current beliefs to absorbing new attitudes and consequently refreezing into this new state.* Hence the journey can only be retraced with great difficulty. Moreover, the journey is only possible if above all else, the leaders learn how to let go. Figure 27 shows the organisational learning as a discontinuous journey over time and not a fixed destination.

It is apparent that, in response to the challenge facing them, companies will attempt to unleash a plethora of interventions, such as BPR and other business enhancement techniques. However, introducing these ideas does not constitute sustainable competitive advantage. It also requires new ways of thinking, new tools to provide leverage for the organisation and new assumptions at critical stages in the journey. Organisations not only have to do things better, they have to learn to do them faster and they have to learn to do them differently.

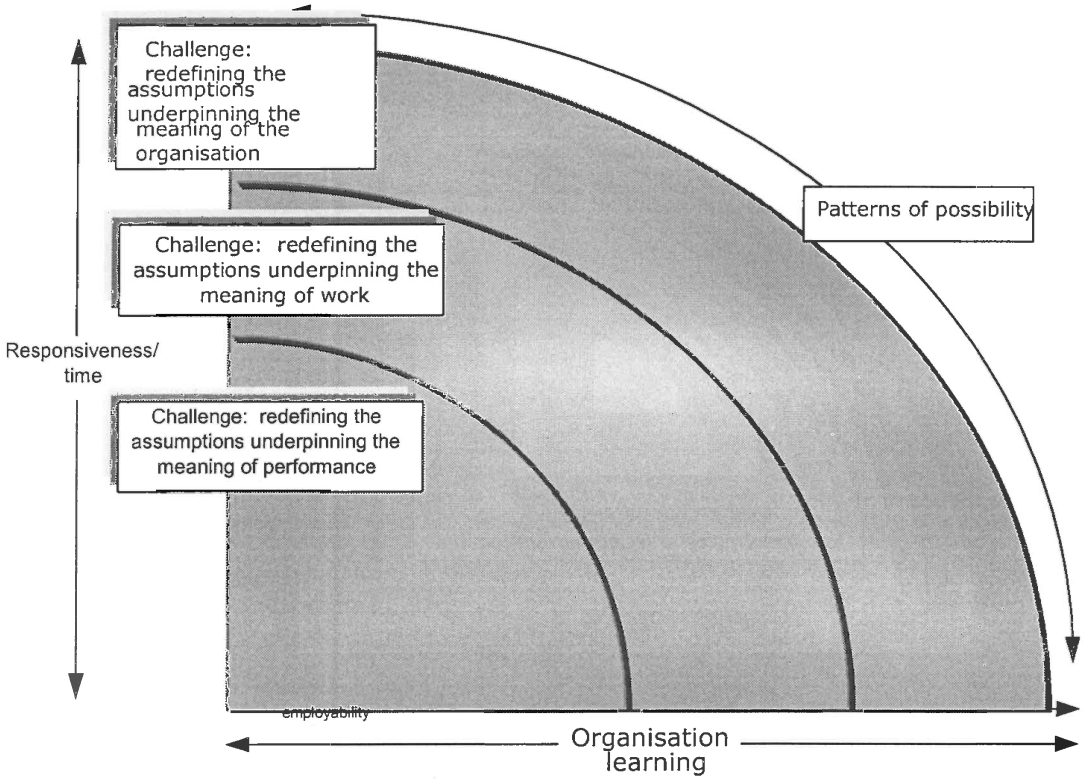


Figure 27: The learning organisation as a journey
Source: Burdett, 1994: 36

It is concluded that: The journey is necessary. Change is discontinuous. Organisations simply cannot stay in their old territory. What remains to be answered is *how* leadership should move the members out of the established comfort zones.

Peters and Waterman [1982], in their search for excellent companies, define the organisation of the future as a hybrid that has to address three prime needs:

- The need for innovation,
- the need for efficiency and
- the need to be able to break old habits.

It is not easy to get rid of the past. The old ways are difficult to relinquish. **The change models described below, attempt to introduce new ways of thinking about the old ways in order to relinquish the latter. In some instances it will suggest new tools to deal with the old ways. The focus is on leadership [see Module VI].**

2.2 CHANGE MODELS

Generally speaking, change efforts can be classified according to the following models [Albert, 1980]:

- The Add Design Model,
- the Delete Design Model and
- the Replacement Design (or Redesign) Model.

These are expanded upon below.

(i) *The Add Design Model*: In this model the change is introduced by the addition of new elements. This is a model of growth and expansion. It presupposes the existence of new and/or unused resources as well as a means to deploy them. Its existence is rooted in the concept of seemingly endless possibilities in establishing new social, economic and organisational forms thus far not employed. This is the New Age model.

(ii) *The Delete Design Model:* In this model change is introduced through the elimination or deletion of old elements.

(iii) *The Replacement Design (or Redesign) Model:* In this model, the change is accomplished by the deletion and/or addition of elements.

There is no real distinction between the Add Design and Delete Design Models. In fact, change is generally a combination of the two processes happening simultaneously, one sometimes leading and the other lagging. The past 200

years have seen a shift from the Add Design to the Delete Design Model, in that the possibility of change has become limited because of man's inability to extricate himself from his past. Albert [1984: 98] maintains that

> *' ..as the environment becomes filled, when opportunity for growth and expansion becomes increasingly limited, change and renewal become possible only with a shift to a model of change by replacement, a model which requires delete design.'*

With the above proviso, the Replacement Design Model is worthy of further development. Because of the constraint as expressed by Albert, literature only reviews the Delete Design Model. An attempt will be made here to adapt this model to the *Replacement Design Model*.

The model consists of four principles given here in the order in which they should be deployed [adapted from Albert, 1984].

- Summarise the past,
- justify the change,
- ensure the creation of continuity between the past and the future and
- eulogise the past.

These concepts are discussed below.

(i) *Summarise the past:* The summary should contain a statement of all that was of significance, tangible or otherwise, in respect of past events, for example what and who the organisation is and would like to be, the corporate culture and identity and performance appraisals. It must tell the story of successes and failures, reflecting the emotional and the cognitive sides. On examination of the times and sites, points of transition and change should be reflected. It is very important that the summary should create a sense of closure in that it locates and conceptualises all essential themes. Nothing important must be left out. This provides a launching

pad for the future. (In re-engineering, this corresponds to the AS IS scenario.)

The difference between the Add Design and Delete Design Model will be apparent here, since the Delete Design Model will focus (in attempting to draw up a closure) on negative aspects from the past, while the Add Model will do so from a positive perspective. A mixed or neutral summary will provide optimum scope, hence the Replacement Design Model.

(ii) *Justify the change:* Provide sufficient reasons for the introduction of something new, explain why the change process is necessary and why it should be done right now. Also justify the extent and magnitude of the change. In this context, one should bear in mind the parable of the boiled frog. Like the frog slowly gets used to the hot water and the reason to escape recedes, the initial justification for change might also slip. The deterioration of the business may occur so slowly that change is deemed unnecessary. (In re-engineering this corresponds to the TO BE scenario.)

(iii) *Creation of continuity between the past and the future:* Since change will always be resisted and few individuals will give up everything, the change should be justified by ensuring that at least some valued elements from the past will be preserved under the new structure. This creates a link between the past and the future and, in the Add Design Model, provides the building blocks from which the add process will follow naturally. In this regard, the Add Design Model wants to build on, to add on new resources to the successes of the past. The term *continuity* refers to the *bridge* between the old and the new. Since the positioning of new structures is a function of events from the past, this should not be seen as contradictory to the discontinuity of the jump.

In defence of this argument, note that Drucker [1994:151] reiterates

> ' .. *although changes in behaviour are required, culture,*
> *no matter how defined, is singularly persistent.'*

He remembers that, although Japan and Germany suffered the worst defeat recorded in history and show different behaviour patterns today, their cultures and values are still very much as they were. Ultimately, what is important, is the degree to which the promise of continuity can be made good by leadership.

To manage the change successfully, one should accept that certain events from the past should be mourned.

This leads to the final principle:

(iv) *Eulogise the past:* The idea is to abstract one core feature from the past, remove it from its context and show how it will function in other settings as a device for creating closure. The method employed is based on the *temporal cohesiveness function* which is, in essence, a plotting over time of the degree to which the organisation and the individual show mutual commitment and cohesiveness. Figure 28 indicates an increase (or decrease) from some baseline in mutual attractiveness (an increase is indicated by a positive slope of the curve at time t). ΔC denotes the change in cohesiveness, that is, a positive ΔC indicates a positive and significant association with the organisation. Mathematically, the magnitude of ΔC is given by the following functional equations [Kimberly and Quinn, 1984]:

$$\Delta C = f (W, N, O)$$
$$W = f (R, I)$$
$$N = f (D, V)$$
$$O = 1 \text{ or } 0.$$

Hence, the magnitude of ΔC depends on whether it is *warranted* (W), *necessary* (N) and whether an *opportunity* (O) exists. Whether or not it is warranted, mainly depends on the *relationship* (R) between the individual and the organisation as well as their *involvement* (I). V denotes the

vulnerability of each party after the separation and D the decision to change.

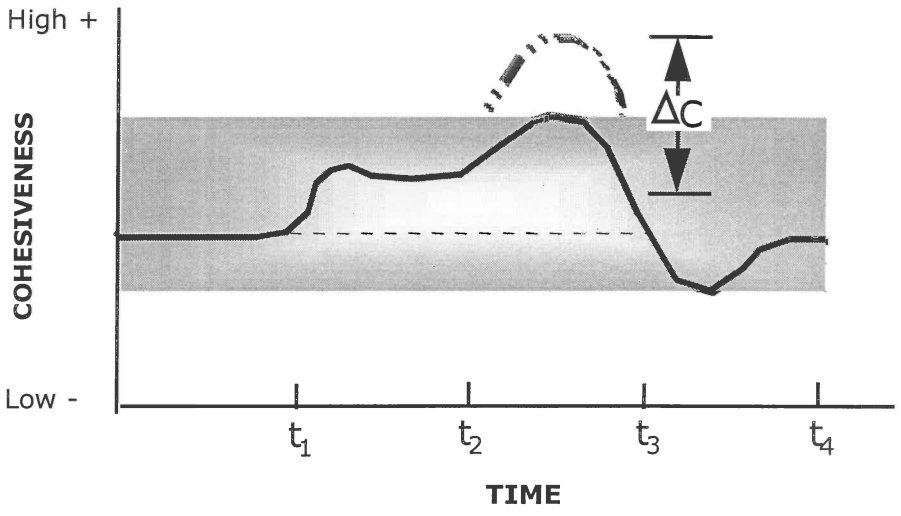


Figure 28: Organisational cohesiveness function
Source: Kimberly and Quinn, 1984: 180

Since high involvement should be highly correlated with high reward [Solomon, 1985], separation (or uncohesiveness) will be difficult when the reason for separation is not coupled to reward. Box Jenkins statistical modelling[6] could be used to model the future as a function of these incidences from the past (at least fifty observations are needed).

Resistance to change, therefore, will occur when an object of great and positive attachment has to be relinquished forever, thereby posing a threat to the organisation's survival.

[6] *The important work of Box and Jenkins [1970] describes an approach to time series analysis, forecasting and control based on a particular class of linear stochastic models, i.e. a collection of random variables ordered over time. The method depends on three time series tools, namely differencing, the autocorrelation function and the partial autocorrelation function.*

The table below shows how the value of ΔC can be used to identify old strategies (or commitments) to be upheld or ignored insofar as it terms them warranted and/or necessary.

Table 20: 2 x 2 matrix of the predicted magnitude of ΔC as a function of warranted and/or necessary strategies

		NECESSARY	
		NO	YES
WARRANTED	NO	ΔC = 0	ΔC = 0
	YES	ΔC = 0	ΔC >> 0

Source: Kimberly and Quinn, 1984: 182

ΔC is hypothesised to be a multiplicative function of whether it is warranted and necessary and is therefore expected to occur in only one cell of Figure 28. When the expression of ΔC is substantially larger than or smaller than that called for by W x N, a smooth transition is unlikely. This function serves as a validation for the purpose of sacrificing or retaining old strategies. In identifying factors using this measure, organisations run less risk of opposition from their members.

These models are generally used as instruments in the planning process and decision-making at all levels of organisational change (sometimes referred to as the '.. *organisational funeral* ..' [Albert, 1980]). When commitment and attachment are too great, this is simply not viable. The Add Design Model deletes resistance to change emanating from the perspective of

'.. *which is more unknown - the past or the future?* ..'

since it operates from the perspective that one only appreciates something after it has taken place and by remembering that the present can be seen as yesterday's future.

2.3 THE REASONS FOR STRATEGIC CHANGE

According to Gresov, Haveman and Oliva [1993], an organisation's ability to respond to changes in its competitive environment, is of central importance to seminal design theories. They maintain that the concepts of competitive response and its opposite, organisational inertia, remain vital to modern organisational theory. Theoretical arguments have linked organisational inertia to a variety of responses, including: the distribution of organisations within populations; organisational performance; and, most importantly, the rates of failure of organisations.

The above authors define inertia as the inverse of an instantaneous rate of change between alternative levels of competitive response. Using such mathematical principles of definition provides organisational design research with a powerful tool consisting of four potential applications.

They identify:

- The use of mathematical modelling techniques (for instance, cusp catastrophe models) to investigate the relative effect of different organisational aspects of organisation linked to inertia. These cusp models portray the responses of a system (for example, the competitive responses of an organisation) as a response surface that is related mathematically to factors that stimulate response (competitive pressure) and the factors that control or inhibit it (aspects of organisational structure and process). Such empirical research may enable the researcher to better understand which aspects of organisational design constrain competitive responses and which do not. This was discussed in Module II.
- The mathematical model handles data relating to both incremental (TQM-related) and radical (BPR-related) change - known as organisational evolution or revolution respectively.
- A model that illustrates the differential effects of various organisational elements, while handling the potential for both incremental and radical change, may be employed as a diagnostic tool in order to capture the

dynamics of the change process and to identify critical points where trade-offs may be prevalent. These changes typically happen over time.

The mathematical conceptualisation of inertia renders possible the quantification of inertia at a given point in time. This is formally defined below.

2.3.1 THE CONCEPT OF INERTIA

In popular terms, inertia may be defined as

'.. a tendency not to move or act'

or, not to *stop* moving or acting.

In its more specific scientific usage, the term denotes

'.. the property of a system by which it remains at rest or continues to move in a straight line, unless acted upon by some external force.'

Schribner-Bantam Dictionary, 1980

The latter definition is often used in organisational literature. Hannan and Freeman [1989] cite various factors that contribute to the stability of organisations and impact on the goals, the core technology and the strategy of the organisation. These are summarised in the following table:

Table 21: Summary of factors that contribute to the stability of the organisation

INTERNAL FACTORS	EXTERNAL FACTORS
Past investments in plant, equipment and personnel	Legal and fiscal barriers to entry and exit from markets
Information-processing constraints	Availability of information due to external constraints
Internal politics	Environmental legitimacy constraints
Organisational history, values and culture	

Source: Hannan and Freeman, 1989: 141

These issues can be studied according to the cusp catastrophe model in Module II and will be briefly discussed here. The catastrophe model can explain both forms of change – incremental and radical – as well as a mixture of both. Specifically, it yields a measure of inertia that is viewed as the inverse of the instantaneous rate of change between alternative levels of competitive response.

2.4 THE NATURE OF STRATEGIC CHANGE

According to Schultheis and Sumner [1992], strategic change can assume a number of forms, that is, the strategies of an organisation can be considered under the following headings:

- *Continuity* – the established strategy remains unchanged.
- *Incremental* – makes sense in the short term, but the environment may change faster.
- *Flux* – no clear direction to the change.
- *Global/radical* – change of this scale happens at times of crisis when the organisation is out of synchronisation with its environment.

These differing notions of change has been adapted from Scultheis and Sumner [1992] and are depicted in Figure 29.

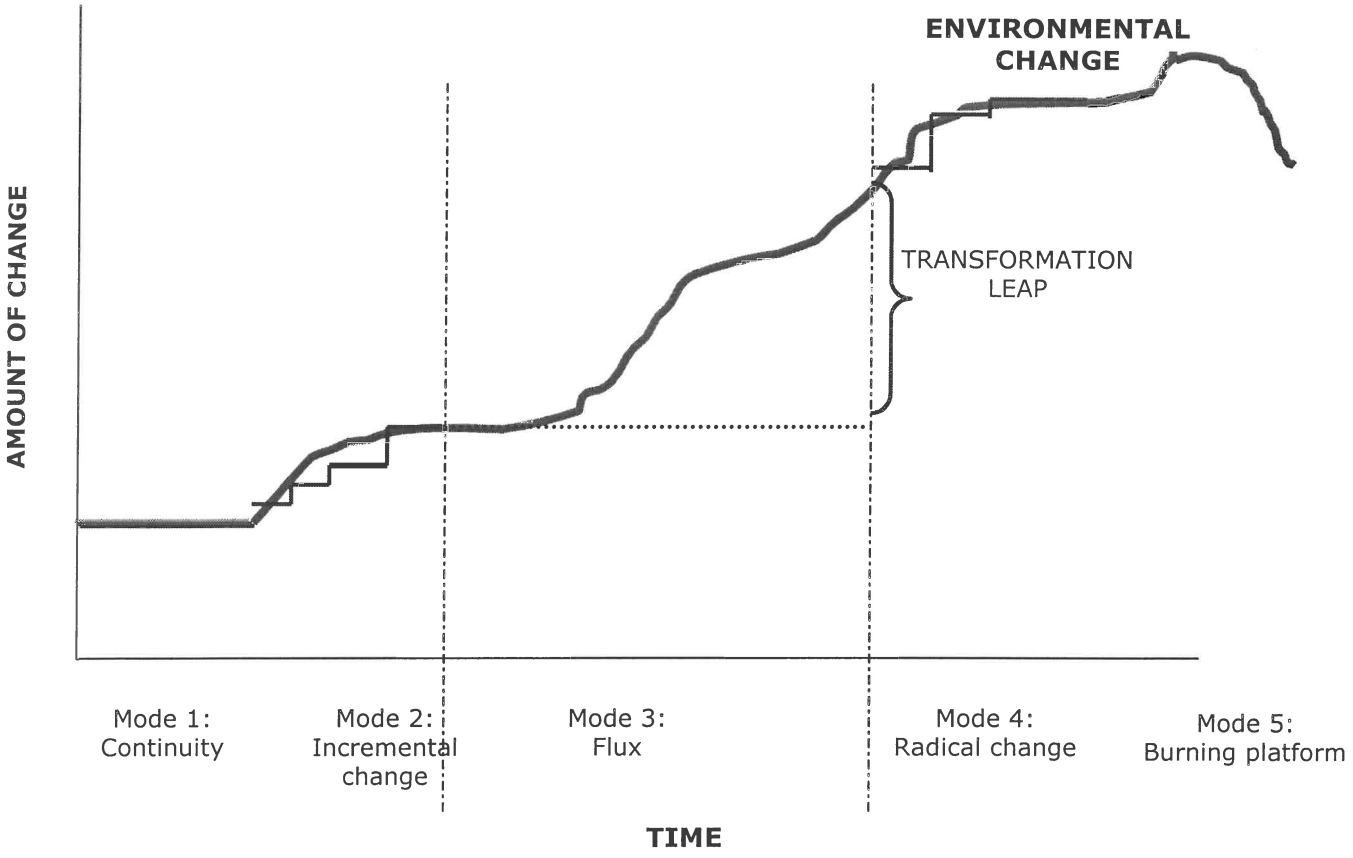


Figure 29: The nature of strategic change
After: Schultheis and Sumner, 1992

Ackoff [1981] suggests four differing approaches to strategic change which, it is suggested, correspond to the above:

- Inactive – mode 1,
- reactive – mode 5,
- pre-active – modes 2 and 3 or
- pro-active – mode 4.

These approaches and their relative advantages are briefly evaluated below.

(i) *Inactive:* Using this approach, the organisation simply goes with the flow and goes about its business with no regard for changes in its environment.

Although, in simply structured businesses this may work, it does involve a high degree of risk. Since the environment is increasingly more dynamic and will force change upon the business anyway, this approach is destined to fail.

(ii) *Reactive:* This is alternatively called '*...planning through the rear-view mirror*', since the tendency is to focus on the past rather than the future, thereby resisting demands of the dynamic future. Most re-engineering ventures use this so-called notion of a *burning platform* or form of crisis management as the basis for change. Such solutions tend to be short-term, and operationally focused. Attempts to change are generally of an incremental nature. The time to change (cusp T_3) was discussed in Module II.

(iii) *Pre-active:* Most organisations which use this approach, try to figure out as best they could, the shape of the future and its effect on operations. They subsequently set out to prepare for that set of events. Hamel and Prahalad [1989: 23] label this approach '*.. maintaining the strategic fit ..*', since it involves focusing on the question of how things will be different in the future. Since it is increasingly evident that the future is first of all different from the past and, secondly, unpredictable (mainly as a result of technological advances) this approach is generally bound to fail. The time to change (cusp T_2) was discussed in Module II.

(iv) *Pro-active:* Although this is the most risky and challenging approach, it is by far the preferred one in which the organisation *designs* the future and *makes* it happen. It is based on the belief that the future is not pre-ordained or fixed and that organisations can, in fact, shape their own destiny. It uses the Tichy [1993] concept of *envisioning* the future whereby an organisation develops a vision of a future state powerful enough to arouse actions necessary for that vision to become a reality. An example of this is Microsoft's decision to promote personal computers at a time when IBM was leading the way and the industry with mainframes. Subsequently, Microsoft invented Windows-based operating systems at a

time when the industry used DOS programmes – and mainframes in contrast to the PCs Microsoft proposed. The time to change (cusp T_1) was discussed in Module II.

The Mayan example [Burdett, 1994/1995] summarises a nation's inability to react to a changing world and their lack of appropriate technology:

Until the late 11th century, the Mayan people lived as they had for 2000 years. During this period, many great cities flourished, each the capital of a small kingdom. Tikal, the greatest of these, covering 23 miles^2, had 100 000 inhabitants. Mayan achievements ranged from architecture to mathematics. For example, they refined the length of the average lunar month to within 24 seconds of the figure determined by atomic clocks. Yet, today the descendants of the ancient Mayans are an oppressed people, having been unable to recover from the Spanish invasion of their land four hundred years ago. Reasons given by anthropologists include the following:

- Technically, they were Stone Age people. They had little or no bronze, no iron and no practical use of the wheel.
- Secondly, land erosion (a direct result of slash-and-burn farming) caused the intricate irrigation canals to become blocked with silt and thus unworkable.
- The Mayan calendar in which they perceived time as a series of interlocking cycles forming repeating patterns. Because of this, the Mayans gave the Spanish 260 years before the latter would be vanquished. This rooted fatalism entrenched in their culture and resignation to the status quo, were probably the main reasons for their virtual abdication of action.

Important change models to achieve the strategic change, include that of Burke and Litwin [1992] having at its heart *leadership* and *organisational culture* (this model has been used by SANLAM in their transformation) or the *Revolutionary Cycle* introduced by Noël Tichy [1993] and used as a framework in this thesis. Tichy advocates the change process as a drama in three acts, that is *awakening, envisioning* and, lastly, *re-architecting* - again with *leadership* at the heart. Both these models embrace the notion that change is a cyclical process and not a

single event never to be repeated. For completeness both these models are presented on the next pages (Figures 30 and 31 respectively).

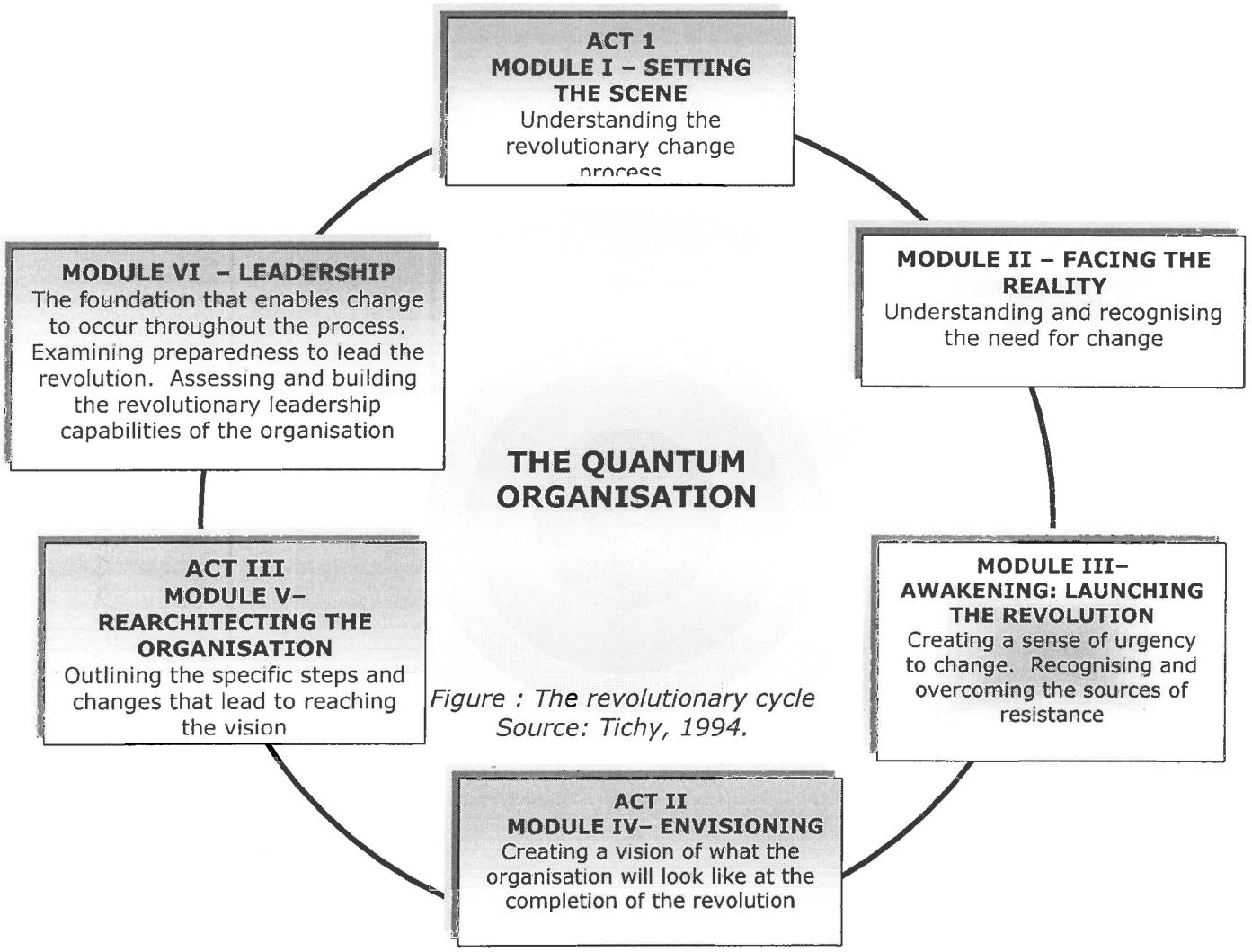


Figure : The revolutionary cycle
Source: Tichy, 1994.

Figure 30: Tichy's revolutionary model for organisational change
Source: Tichy, 1993

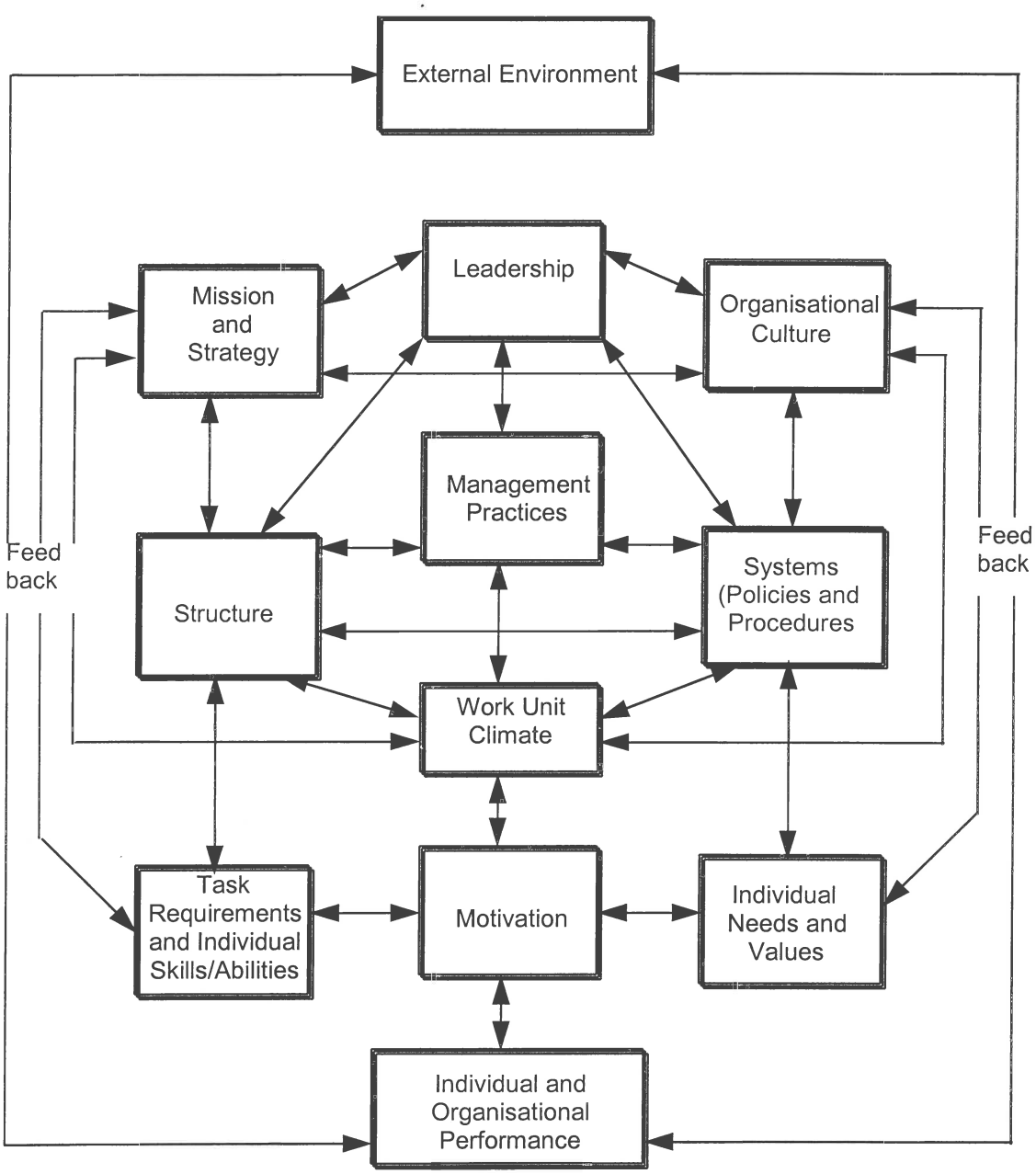


Figure 31: A model for organisational performance and change
Source: Burke and Litwin, 1992

3. THE CASE FOR RE-ENGINEERING THE CORPORATION

Before any attempt can be made to study the concept and consequences of re-engineering, it is necessary to formulate the original definition provided by Hammer and Champy, since much of the discussions to follow, will be based on this. They [Hammer and Champy [1990: 32] define BPR as follows:

'Re-engineering involves the fundamental rethink and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality service and speed.'

This definition will form the baseline of much of the discussions to follow.

3.1 THE PROBLEM WITH MAN-AS-MACHINE

Although the metaphors have changed over the centuries, the idea of designing (or engineering) an organisation for maximum efficiency or effectiveness, in the way that one would design a machine, is not new. The creation of wealth has always depended fundamentally upon people acting as machines. Whether in agriculture, manufacturing or services, in ancient or modern times, efficiency and effectiveness have relied upon workers repeating tasks with discipline, precision and predictability.

Traditionally, these tasks have been physical ones, for instance, sowing crops evenly and harvesting them cleanly, spinning and weaving for a regular and unflawed cloth or working metals and preparing chemicals. The most common modern image, is that of the assembly line and the classic applications of industrial engineering were in automobile manufacturing. The principle also applies to administrative and service functions, and skilled and unskilled labour. Many people, from machine operators, to actuaries and auditors perform best as machine-people. As machines, they are reliable and efficient. As humans, their

propensity to innovate, think and to depart (accidentally) from scientifically prescribed procedures is a liability resulting in added costs and lower quality.

This presented the greatest challenges to business and society in the search for wealth creation in the past, namely:

- To maximise the machine potential of the work force and
- to control their unpredictable (human) behaviour.

Source: Hendry [1995].

With relatively simple tasks, the main emphasis was historically, on control – even through simple and overt oppression. However, with the complex task characteristics of modern organisations, these controls are no longer sufficient. It has become necessary to redesign the organisation's processes (and the tasks within them) while maximising the efficiency of the machine process.

From the above, it is evident that the management models presented in Section 1 of this module are not adequate to address the needs of the Information Wave. The focus consequently shifts to the processes of the business.

3.2 PROCESS-FOCUSED INDUSTRIAL ENGINEERING

How can companies transform themselves for the new economy? In the 1980s, the main management tool for change was *quality* [Tapscott, 1995]. The total quality and continuous improvement movement enabled many organisations to respond to the newly emerging global situation. In the 1990s, the attention shifted to Business Process Re-engineering (BPR), a management technique that swept through organisations and governments around the world. It is true that old business processes, management practices, organisational structures and ways of doing work have become inappropriate for the new volatile, global, competitive business environment. Clearly many organisations needed to re-engineer to reduce their cost base or to maximise profit.

Whereas earlier versions of industrial engineering restricted their attention to efficiency, newer trends also embrace effectiveness. Porter's value chain [1985] and the TQM, focus not only on the costs associated with processes, but also on the value generated for customers. Porter's value chain model is particularly powerful as an engineering model of the operations of an organisation. The creation of products and services is broken down into processes, sub-processes and individual tasks. This added information is used to design a new and better machine to maximise customer value, by eliminating tasks and processes which do not add value. Some argue [Hendry, 1995] that the emphasis in the value chain is too much on tasks and not enough on outputs, that it starts with a process and seeks to maximise value, rather than starting with the value and seeking to minimise process.

Proponents of the value chain concept argue that there is no point in redesigning processes without looking at their linkages to other processes. The importance is the reconfiguration of the whole value chain and not the processes within it.

To achieve large gains in productivity, technological improvements should generally be combined with significant changes in management and organisational structure, and the reorganisation and redefining of work practices. This radical change is referred to as BPR. A business process is one or more tasks or activities that add value to an organisation or to a customer. Re-engineering consists of four generic phases.

These are:

Phase 1: Thorough analysis of the current situation - AS IS scenario.

Phase 2: Fundamental rethinking, and complete redesign of essential business processes (to achieve dramatic performance improvements in service, quality, speed and cost) - TO BE scenario.

Phase 3: Transformation to achieve the objectives of the second phase and

Phase 4: Evaluation to determine whether the objectives were attained and whether there should be further changes.

BPR is not a process of trying to make marginal improvements. Rather, it ignores how work is now done and starts over, from scratch (see mode 4 in Figure 29). It is a revolutionary process that challenges all the old organisational structures, work flows, job descriptions, management procedures controls, and organisational values and culture. It discards those that make businesses under-perform and replaces them with more effective and efficient processes. In other words, BPR is a re-invention of business processes rather than an improvement or enhancement of them. (Refer to Module II, Section 4.)

The idea of *radical change* caught on fast because of the recession and probably because of America's habit of not bowing to tradition. Those applying the label '*efficiency through re-engineering*', advocate the adoption of radical means to achieve corrective actions. The extremism of the approach seemed to offer instant relief from the pressure on leadership to show immediate improvements. It calls for discarding all existing institutions and reconstituting an organisation on the basis of completely fresh ideas – the new business model is expected to spring from the inspired insights of a new leadership team.

There are two propositions to re-engineering, the one being that of re-engineering the business processes and the second of a more radical nature, namely that of re-engineering the business. Whether these two conjectures could be construed as having the same solution, is debatable. Re-engineering an entire organisation rather than a function or unit only, is an extraordinarily complex undertaking [Jordan, 1996]. The human and organisational complexities exceed those arising from technological innovations. The top-level strategic redesign is made first and the subsequent redesign of lower level processes must support that new top-level design. The reality of time-based competition necessitates a simultaneous re-engineering of the various elements of the organisation. This further increases the complexity of the re-engineering. Control by enumeration becomes virtually impossible and, if attempted, may defeat the re-engineering effort.

The concept of BPR is not new. It is a contemporary repackaging of industrial engineering methods. The US Navy used the concept around the turn of the century. Henry Ford performed BPR on the automobile manufacturing in 1910.

The BPR theory restates both aspects of Karl Marx's synthesis:

- Revolution over evolution and
- holistic process over fragmentation.

After: Sanders [1997].

At the heart of re-engineering lies the notion of *discontinuous thinking* – of breaking away from outdated rules and fundamental assumptions that underlie operations and of *jumping the curve* of the existing ways of doing business. Breakthrough performance improvements cannot be achieved unless there is a challenging of old assumptions and a shedding of the old rules that made the business under-perform in the first place [Hammer, 1990]. Every business is replete with implicit rules from earlier decades. These rules are based on assumptions about technology, people and organisational goals that are no longer valid. The contemporary repertoire of IT is vast and expanding. Quality, innovation and service are more important than cost, growth and control. The work force wants to share in the decision making and have control over their jobs. This is in contrast to the old hierarchical models prevalent in the Second Wave and requires a radical rethink of work processes and control mechanisms.

Hammer and Champy [1990] laid down seven principles for successful re-engineering – in all of which IT acts as a contributor and enabler:

1. Organise around processes and outcomes, not tasks and departments,
2. Have output users perform the process.
3. Have those who produce information process it.
4. Centralise and disperse data.
5. Integrate parallel activities.
6. Empower workers and use built-in controls.
7. Capture data once, at its source.

These steps towards successful re-engineering will show the use of IT in the re-engineering process. The effect of IT on these will be studied in the section below.

Tremendous benefits accrue from BPR. The CSC Foundation Index report [1994], found that BPR produces an average improvement of 48% in cost, 80% in time, and a 60% decrease in defects. After Citibank re-engineered a credit-analysis system, its employees were able to spend 43%, instead of 9% of their time recruiting new business. Profits increased by 75% over a two-year period. When Datacard Corporation re-engineered its customer-service operations, its sales increased sevenfold. Bell Atlantic reduced both the time (fifteen days to a few hours) and the costs ($88 million a year to $6 million) required to convert customers to long-distance carriers.

4. IT AND RE-ENGINEERING – SECOND-GENERATION RE-ENGINEERING

Between 1983 and 1993, when over a trillion dollars was spent on IT, productivity increased by a mere 1% [CSC Index Foundation, 1997]. Businesses merely used computers to speed up their paper flow and manual procedures, and continued to use methods that fail to make use of the powerful processing capabilities of today's computers. Host IS were unable to handle the flood of new information available or to take advantage of the steady stream of new technological advancements. With the advent of networks and powerful desktop computers, the technical capability to do things very differently than previous generations did, is available and should be (and are) investigated.

4.1 THE CASE FOR IT

For many years, organisations have applied the concepts of Industrial Engineering to their production processes, with administrative processes and services

remaining largely untouched. After World war II, the Operations and Management (O and M) movement did seek to apply industrial engineering principles to administrative work, using the new data-processing technology of the time [Hendry, 1995]. Technology was still limited and the emphasis was on automation and streamlining of existing processes rather than on rethinking the processes themselves. At the time, the technological advances were not such that they could impinge upon these processes. O and M lost its drive and radical process innovations passed to IT specialists, software providers and systems consultants. The technology and environment advanced, but the processes (designed to meet specific circumstances and a particular business and technological environment) remained unchanged. Processes only changed incrementally and without any holistic determination.

The message to be gleaned from the new Industrial Engineering is that wastefulness is unsustainable. Disciplines already applicable to manufacturing processes, must now be applied throughout all organisational processes. Not only the production line, but all aspects of the organisation must be engineered. Modern IS provide the technology to do so. Not only is IT deemed by some to be the critical basis of the newly engineered processes, it also provides the ability to undertake the redesign, maximising value added and minimising costs over the large range of interdependent variables that enter into a complex administrative system. Hendry [1995] believes that when the core technology of administration changes (as with the rapid development of IT), when the commercial environment changes, leading to changes in relative costs and values, or when the strategy of the organisation changes, configuring the value chain in line with the new circumstances and objectives must be the right thing to do. Enhancement of value added and the minimisation of costs must be the core objectives of this configuration, with the choice of strategy determining the balances between them.

It is suggested that IT has emerged as strategic tool to create business advantage, an aspect that will be enlarged upon below.

Underlying each of the seven principles laid down by Hammer and Champy in Section 3.2, is the use of IT such as user-friendly software, expert systems, imaging technology, mobile computing and networks of personal computers. Expert systems encapsulate the expertise of specialists in a computer-based system. Imaging technology makes it possible for users at different locations to access and work with the same information at the same time. Mobile computing allows people to keep in constant communication with their companies and their customers. Local area networks (LANs) connect multiple users in a single location, and wide-area networks (WANs) connect users in multiple locations.

The following have been identified as ways that IT can be deployed to accelerate the re-engineering process:

- Develop the capability to build design prototypes and production prototypes concurrently.
- Treat prototyping as a real-time business solution discovery process, not just systems specification.
- Adopt object-oriented tools and methods to speed up implementation without compromising flexibility.
- Apprentice IS staff on new processes, tools, and working methods ahead of their involvement in re-engineering, not during it.

[After: DiRomualdo and Turton, 1995].

Models incorporating the use of IT with change, will be studied next. A Technology Change Model will also be proposed to link IT to BPR.

4.1.1 TICHY'S CHANGE MODEL USING IT

Tichy's change model presented in Module I follows from his notion that there are three spurs (internal and external) that drive the organisation to change. This is known as the Technical, Political and Cultural (TPC) framework and is presented in Figure 32.

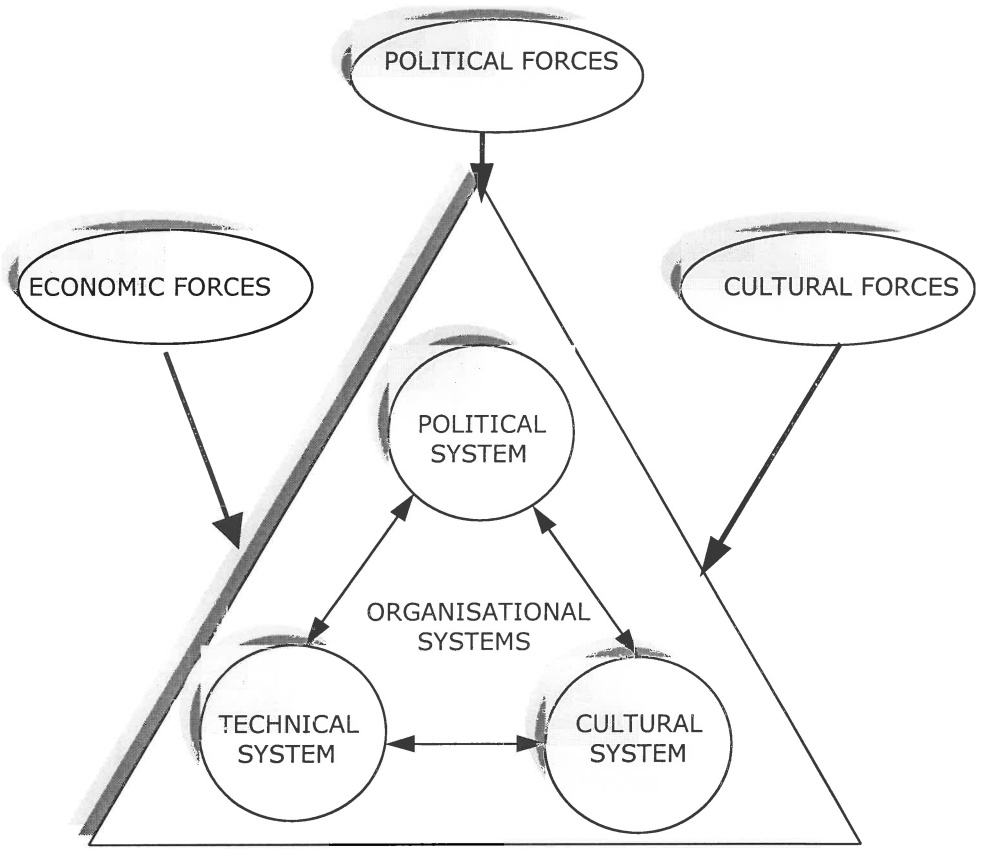


Figure 32: Tichy's TPC model showing the internal and external forces that drive the organisation to change
Source: Tichy, 1993: 242

According to this model, technology is one of the three driving forces behind change – be this an external or an internal force. The TPC issues can be seen as three intertwined strands of rope [Tichy and Devanna, 1990].

Expanding on the rope metaphor, they reiterate that:

- From a distance, individual strands are indistinguishable.
- Closer examination of the rope reveals that each strand is made up of many sub-strands, and, finally,

- The strength of the rope depends not only on the strength of the strands it is made up of, but also on their connection. A rope may unravel and an organisation may come apart when its systems work at cross-purposes.

Moreover, each of these systems influence the organisation in the following way:

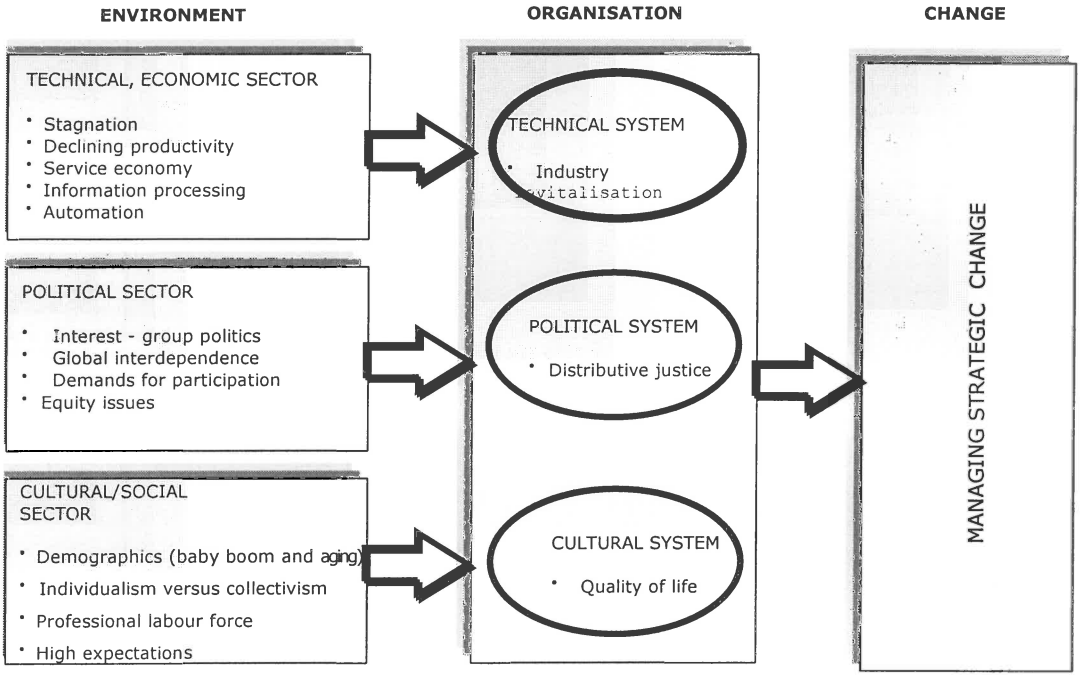


Figure 33: The influence of technology in effecting strategic change
Source: Tichy and Devanna, 1993

Although Tichy and Devanna did not delve any further into the detail on *how* technology acts as a driving force and enabler of change, their research shows clearly the force of technology as a revitalising agent for competitive advantage. They did not elaborate on what form the technology should take on; nor did they differentiate between existing and new technology or reflect on the scope of the technology deployed. They did however, propose the revolutionary change model [Figure 1] that has been used as a road map through this thesis. These two figures clearly illustrate the case for IT in re-engineering (the so-called second generation re-engineering). They also serve as introduction for the development of the Technology Change Model (Figure 34) presented in the next section.

The above leads to the proposition of a Technology Change Model which links the extent of new technology to the scope of the change. It also presents organisations the opportunity to reflect upon the effect of new (or existing) technology (mainly IT) on radically changing the organisation and its business processes. The model follows from a proposition by Miller [1997] and subsequent studies and consultations this author has had in terms of the re-engineering and IT implementation in South African organisations.

4.1.2 PROPOSED TECHNOLOGY CHANGE MODEL

The Technology Change Model suggested in this thesis [Figure 33], is derived from one proposed by Miller [1997] in terms of knowledge applied and aspects of change. Miller introduces the term: *'out of concept problems'* (OCP) as those business problems at a level where incremental change is impossible to achieve expected positive results because of changes (economic, political, cultural and technological) inside and outside the organisation (refer Figure 29 on the nature of strategic change, Tichy's TPC model in Figure 32, and the effect of technology in effecting strategic change in Figure 33). Discontinuous (radical) change becomes the only possible solution. Moreover, the process is irreversible and different from the past (refer Figure 5 on jumping the curve). Miller likens this to the existence of villagers before and after the arrival of the European explorers. Everything they used (including technology, community structure, knowledge and power) changed irreversibly. This analogy corresponds to the notion of radical change in business re-engineering – one way of achieving this being through using the appropriate (information) technology.

Miller maintains that using standard technology of change, means being guided by knowledge acquired in different circumstances that are similar but not the same. From Miller's suggested model for aspects of change and knowledge applied, the following model is adapted to show the link between information technology and scope of change:

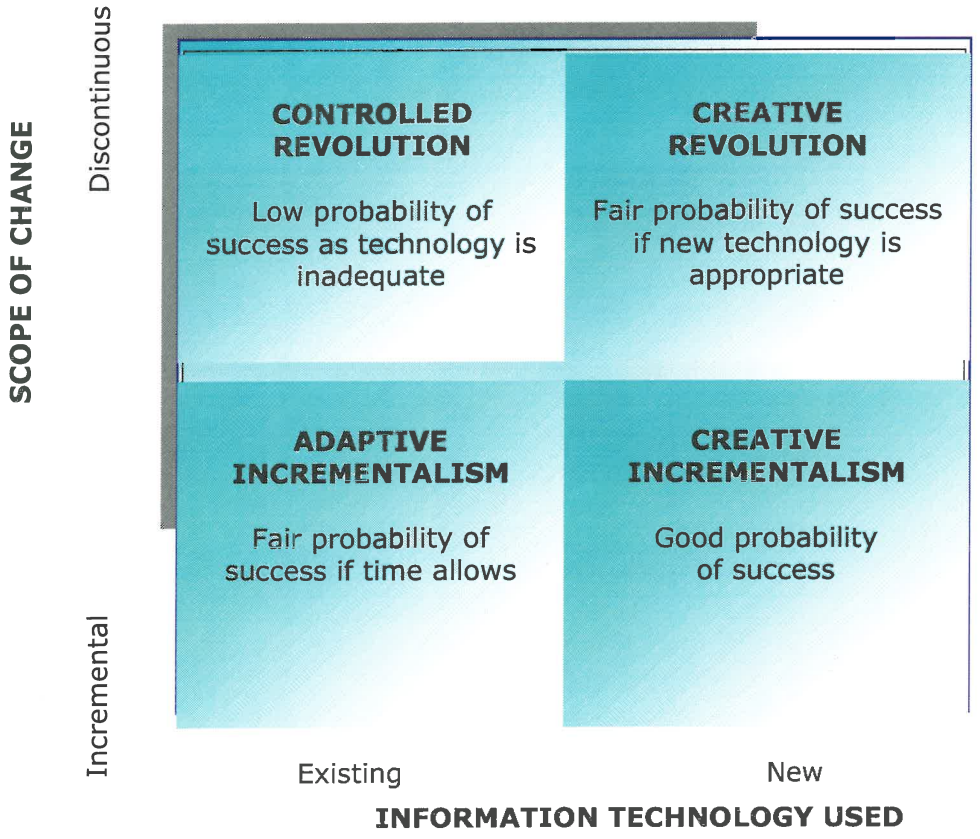


Figure 34: The link between information technology and the scope of change

This model will be discussed in greater depth below.

(i) *Creative revolution*: Creative revolution in the context here, signifies that radical change is executed and has to be sustained in the long term. A significant example of this is the implementation of the SAP/R3 (or R/4) ERP system that involves the acquisition of new technology (hardware and software) and a general re-engineering (sometimes, second generation re-engineering) of the processes around the new system. Organisation that have embarked on this form of change include Transvaal Sugar Mills, ISCOR, SASOL and University of Cape Town. The time taken to fully achieve implementation is generally lengthy. Generally, the change is perceived negatively by employees, culture can act as barrier to the change and it is important to obtain complete buy-in from all stakeholders (especially users) before this costly and lengthy venture is undertaken.

This follows the earlier notions of jumping the curve (Module II, Section 4). Since this issue is currently relevant to most South African organisations, the issue of BPR and ERP will be specifically dealt with in Section 4.2 of this module.

(ii) Controlled revolution: Controlled revolution, on the other hand, also involves radical change, but the latter is not necessarily sustainable. Furthermore, existing technology is used. Whether it is possible to introduce sustainable radical change without new technology is highly debatable, mainly because of technology's advancement as a strategic tool in the Information Wave. Such companies generally embarked on a re-engineering exercise without using the capabilities of technology to orchestrate the change. The re-engineering generally ends up being no more than restructuring or downsizing, and benefits are short term and problems persist in the long term.

(iii) Adaptive incrementalism: This kind of (incremental) change involves the application of control systems used in other parts of the organisation without the introduction of new (information) technology. Since no new technology is introduced, the change is generally incremental and fragmented. The need for change may occur in the near future. Generally, cost can be controlled and there is buy-in from stakeholders.

(iv) Creative incrementalism: In this process of change, new technology is used, although incremental change was needed. Technology is not used to its full potential and the organisation has probably overcapitalised. There is no real jumping of the curve. Organisations that do this, will generally blame the implementation of a system (like SAP R/3) as being too costly and not to their benefit. The organisations are generally *au fait* with all of the latest change technology but have not thought it through and grasped the real benefits that technology may deliver. This author likens this to the 'keeping up with the Joneses effect'. It is also possible that organisations that co-operate along the same supply chain may decide to implement the same IT systems to facilitate business to business

applications and easier information flow. This author believes that this is possible depending upon an organisation's specific business culture and mindset and this will be addressed again in Section 4.4 of this module where a case study involving two organisations implementing the same systems but with different outcomes are presented.

In all of the above, the question of timing has mostly been ignored. The decision to change (especially if it involves expensive technology) has to be timed according to the following:

- The readiness of the organisation (especially in terms of culture),
- the information needs of the organisation,
- the environment (competition, clients, supply chain) and
- the specific information delivery systems to be implemented (refer Figure 19).

It is possible to change over a fairly short period of time, provided that the change is not of immense proportions. As in any re-engineering exercise, instituting new technology requires developing a vision of what the organisation wants to achieve. The organisation then subsequently decides what it should do to attain that vision of the future. This could entail new or stronger leadership, teamwork and collaborative decision-making. Miller [1997: 20] notes

'Often change in a business is a fulfilment of the vision of a predecessor or a more senior executive.'

Revolutionary change requires a sharp redistribution of the new reality. It has a far greater probability of success if the new reality is not totally at odds with the present reality. If the proposed change is too extreme or impinges upon the comfort zones of employees, the organisation runs the risk of employees displaying the so-called *'bohica effect'* (namely, the slow grinding down of the will to change from within the organisation).

The above model is in the process of being validated through several studies of South African organisations that are implementing new IT and being in the

process of transformation. The reader is referred to Hawking's beliefs of the validity of scientific theory in the section on the research strategy deployed. It is also contended that the model is just as valid in the sphere of IT as in a broad technology domain.

4.1.3 MULTI-DIMENSIONAL MODELS

The following multi-dimensional models have been proposed by the CSC Index Foundation [1998]. They maintain that it is important to identify the appropriate model for a particular situation and that some of these models are better suited to re-engineering than others. These models provide a useful framework around which to structure assessment of re-engineering. The models differ among multiple dimensions, as shown in Figure 35 below. Each model emphasises different beliefs and values regarding IS and IT capabilities and the role of IT in the business.

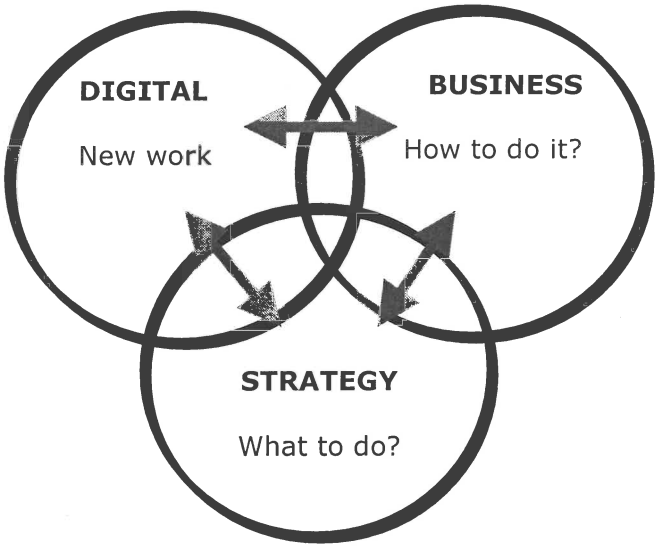


Figure 35: The multiple dimensions addressed by a migration of IT models
After: CSC Foundation Index, 1998

The models and their evolutions are:

- The Provider/User Model,
- the Partnership Model, and
- the Pervasive Model.

There is some migration from the Provider/User Model to the Partnership Model and, subsequently, to the Pervasive Model.

(i) *The Provider/User Model*: Assumes a transactional relationship. The business specifies its information needs and IT delivers these in the most cost-effective manner possible. Systems changes are formally planned. This model is geared toward stable business and technical environments and is not well-suited to re-engineering.

(ii) *The Partnership Model*: Assumes a stronger sense of shared goals and ownership between IT and the business. Relationship management becomes a critical process. The emphasis is on meeting the real needs of the business, and there is recognition that this requires more flexibility on the part of both partners. The technology deployed should support flexibility and diversity. This model of IT, with its emphasis on providing a quick response to the business and rapid deployment of technology, is far better-suited to re-engineering than the Provider/User Model.

(iii) *The Pervasive Model*: IT provides a generic information infrastructure and the business applies that infrastructure to its needs. The nature of the infrastructure, which can be thought of as the language of the business, requires a closer relationship and collaboration between the IT department and the business unit. New technologies should be introduced directly into the infrastructure. Technology services will acquire new, finer-grained responsibilities. **The Pervasive Model provides the business and IT with an IT capability that enables them to anticipate, implement and support, radical change.**

It has been this author's experience that integration and collaboration between outside contractor and the IT department within the organisation,

provides the most painless (and less costly) transition to new IT systems and has a higher success rate on buy-in from the internal stakeholders and users. This is contentious as it in a way overrides possible outsourcing of the IT function – especially with regard to the proposed organisational forms in Module III (namely the Shamrock, the Federal and the Triple I organisational forms).

Since the Pervasive Model lends itself best to the re-engineering process, this model will be studied in more detail in Figure 36 below.

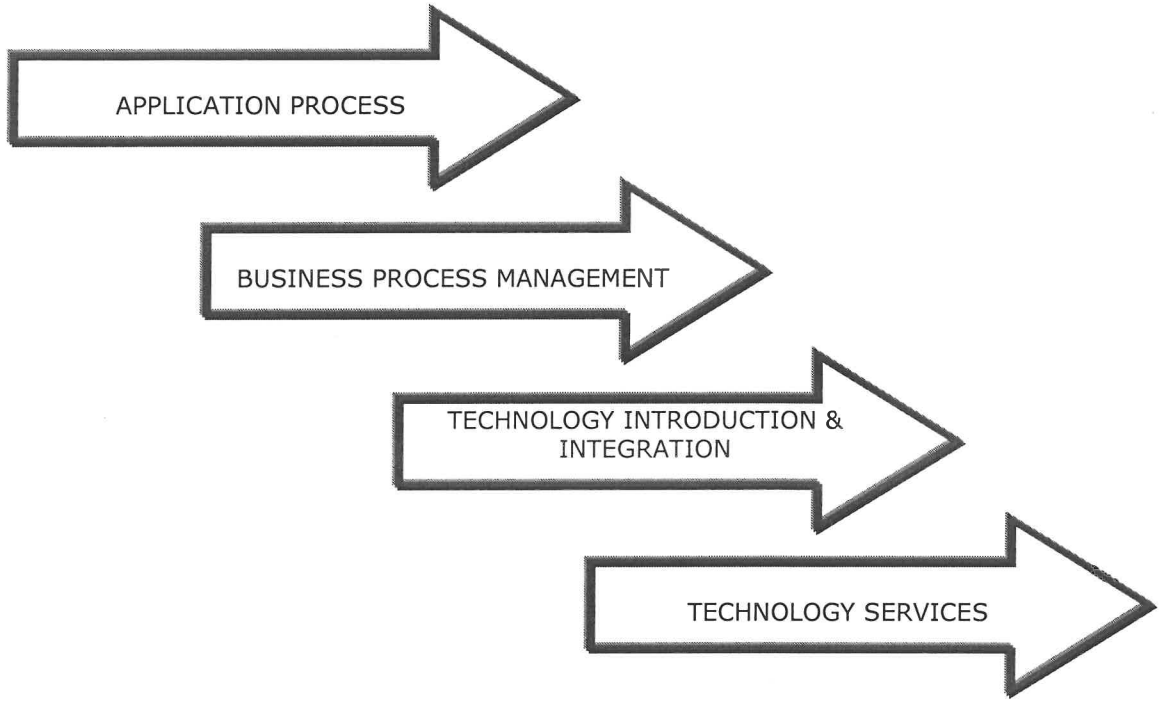


Figure 36: Processes in the Pervasive Model
After: CSC Foundation Index, 1998

Table 22 below provides a summary of the three models and the IS/IT applications within each.

Table 22: Application of multidimensional IT models to BPR

		MODEL	
APPLICATION	**PROVIDER/USER**	**PARTNERSHIP**	**PERVASIVE**
ROLE OF SYSTEMS IN BUSINESS	Improve efficiency and performance; reduce costs	Support business expansion, diversification and local variation	Facilitate responsiveness to future change
MIND-SET OF IT	Deliver what the business asks for	Understand what the business needs	Anticipate future needs of the business.
CRITERIA AGAINST WHICH IT IS EVALUATED	Cost, availability, comprehensiveness	Attitude, timeliness, fit against needs	Transparency, accessibility, pro-activity
NATURE OF SYSTEMS	Large, mission-critical applications; management-control information	Opportunistic systems	Infrastructure, not applications; uncommitted systems; expressive systems
KEY TECHNOLOGIES AND APPROACHES	Parallel processing, transaction monitoring	4GLs, relational database, downsized systems	Client-server, object orientation, peer-to-peer networking
ROLE OF PACKAGES	Cross-functional, integrated applications; buying best practice; industry standardisation.	Portfolio of smaller packages, rapid development, limited but easy local tailoring	Packages to provide technical functionality; package for front-end integration; no applications packages
IT ORGANISATION STRUCTURE AND ORIENTATION	Functional structure, technical and operational orientation	Processing structure, tactical customer orientation	Process structure, strategic business orientation

After: The CSC Foundation Index, 1998

Returning to the principle of technology innovation in Module IV, the following table summarises the different IS functionalities in order to minimise cost and maximise business opportunities.

Table 23: Technology innovation in respect of the models above

IT MODEL	LEVEL OF TECHNOLOGICAL INNOVATION
Provider/User Model	Used to drive down overall cost of computing. Increase efficiency and productivity of computing assets.
Partnership Model	IS uses advanced technologies to render possible the production of new products, expansion of markets or respond to specific market demands.
Pervasive Model	The imperative of technology innovation changes and becomes central to the work of IS. It is the most important work of IS. Future technology innovation will focus around designing and building robust IT infrastructures that will be the foundation of the business and will enable the business not only to operate, but also to permutate quickly as required by the continuously changing environment.

Source: CSC Foundation Index, 1998

The table above clearly shows that technology innovation becomes one of four major processes of the IS organisation in the Pervasive Model. The activities involved in technology innovation in this model extend beyond those of the other two and assume a clearly defined and value-added role in the organisation. This model focuses on the identification and implementation in the organisation's technical infrastructure of those technologies enabling the organisation to respond to market demands speedily, flexibly and in different ways. The IT challenge is to anticipate the business needs, analyse new technology offerings, replace them and encourage and support innovation throughout the organisation. Thus new technologies continue to be introduced into individual business units. However, each new technology is studied in terms of its value to the organisation as an entity. It is also separated into discrete capabilities for ease of individual use.

With the migration to the Pervasive Model, principles of technology innovation are valued and carried out in the organisation as an essential first step. The stages necessary for technology innovation in the Pervasive Model have been identified as:

- Identification and communication of new IT,
- implementation of new technologies in the infrastructure and
- evaluation of the infrastructure.

These are summarised in the subsequent figure (Figure 37) and discussed below as they are relevant to both the costs of IT investment and the linkage with BPR.

Figure 37: The technology innovation process in the Pervasive Model
Source: CSC Foundation Index, 1998

(i) *Identification and communication of new IT:* The principle objective is to identify those new technology concepts that are relevant to the organisation's goals and objectives. Identifying new concepts entails having the intellectual willingness to explore and running a business laboratory to continually explore and translate new technology concepts into business value.

(ii) *Implementation of new technologies in the infrastructure:* The overall process in the Pervasive Model is called technology and integration, since its objective is to integrate new technologies directly into the business. The key to this model is a generic service definition that is strongly architectural in nature.

(iii) *Evaluation of the infrastructure:* This entails monitoring the natural life cycle of key technologies within their infrastructure, planning in advance for replacement of each technology before it becomes obsolete. The difficulty is in managing the influence of any one technology over the architecture. Thus it is suggested that dependency on a specific component should be minimised. In this, the organisation should employ skilled staff to execute the technology innovation.

It is suggested that organisations put in place the resources (people, structures and relationships) that will encourage migration and implementation of technology innovation in the Pervasive Model. Making the transition to a process-oriented workplace in both IT and business environments, focusing on the value-adding activities, will result in increased efficiency and productivity. With the establishment of centres of excellence to handle the levels of technology innovation mentioned above, organisations will develop and refine the sophisticated skills sets required of all members of the organisation if they are to be competitive in the Quantum Age.

With the current interest in ERP systems (refer to Figure 19), the following section specifically studies re-engineering the business processes and the implementation of ERP solutions. It also looks at the order in which these implementations (BPR and ERP) should be done for maximum strategic advantage for the organisation.

4.2 BPR AND ERP – AN INTEGRATED APPROACH

According to Davenport [1995a], one of the key success factors to a holistic approach to ERP-related change, is the need for a simultaneous and integrated approach to strategy, organisation, process and systems change. The key issue under discussion is the timing of business process re-engineering (BPR), that is, when a company should consider the implementation of an integrated packaged (ERP) solution. The notion of ERP was discussed in terms of the information delivery matrix in Module IV, Section 3.3.

Three alternatives are considered:

- Re-engineer first, then automate,
- re-engineer and automate simultaneously or
- implement ERP first, and subsequently re-engineer from a stable base.

Each alternative has associated risks and benefits. None provides a clear-cut indication of a 'best' approach to BPR and ERP. The same goes for ERP solutions. Their value (short term and long term) is calculated, but so is the price organisations pay for packaged solutions. A comparison between the best practices for ERP and BPR reveals common ground. Both bring significant change to an organisation and its people, and both have increased process performance as their objective. Companies which have managed to successfully complete both ERP and BPR projects are few, but have shown spectacular improvements.

Given the similar approaches to ERP and BPR, a hybrid approach is suggested with projects containing separate but integrated re-engineering and system implementation components. The tough choice many companies have faced over the past few years (and some of the late adopters still face this) is whether to re-engineer processes *before* implementing ERP solutions; to do so at the same time as implementing ERP; or to do so after the implementation. In some instances they even question whether they really need any form of process review at all. The trusted wisdom of not automating old, inefficient processes, or 'paving the

cow paths', [Hammer, 1993: 23], is being ignored with a lack of resources (especially time) mentioned as the reason.

The days of re-engineering being *the* solution may be over, but most managers realise that the need to identify, improve and manage business processes did not vanish with the decline in popularity of re-engineering. Now, more than ever, companies are realising how expensive and restrictive outdated processes are for them. ERP is looked upon as the silver bullet to resolve the millennium problems, as well as clean up processes at the same time. ERP software is designed to model and automate many of the basic business processes of a company, with the goal of integrating information across the company and eliminating complex, expensive links between legacy systems. The price organisations have to pay for this automation is high. According to Davenport [1998], the real challenges companies face after successful ERP implementations are to use the resulting process-oriented, real-time, global information to change how the company manages and does business.

The key questions to be answered when companies are considering ERP and re-engineering are:

- To what extent re-engineering is needed,
- which processes should be re-engineered,
- when this should be done (before, during or after the ERP project) and
- what the benefits and risks are to be considered.

The major issue is to identify how re-engineering fits in with the ERP. Three alternative solutions are suggested:

(i) Re-engineer first, then automate:

In a perfect world, one would like to complete rigorous re-engineering, using a clean-sheet approach before looking at any system solution. ERP would then be waiting, ready to automate and fulfil the company's every

demand streaming from the new processes. This is an overly idealistic viewpoint.

If one takes a 'blue sky' approach to re-engineering, the results often do not translate into implementable solutions. SAP R/3, the leading ERP package, hardly offers a clean sheet of paper for process re-engineering. The package, or any of the major ERP packages for that matter, consists of a complex array of structured processes which will dictate change and subordinate ambitious re-engineering goals to getting the system up and running.

Davenport, who participated in the creation of re-engineering together with Hammer and Champy, equates the

'Let's re-engineer from a clean sheet of paper
and then see what ERP can do for us ..'

to rewriting one of the SAP modules [Davenport, 1998: 36], thereby showing the complexities involved and the linkage between the two.

According to Bancroft [1998: 39]

'You don't want to get too far down the re-engineering
path without keeping R/3 in mind.'

(ii) Re-engineering and automate all at once:

Theoretically this principle may be sound. However, ERP systems are generally difficult and costly to implement. The major reason for this may be due to the way they change people and their roles in the organisation. People are dealing with levels of integration never experienced before. ERP forces every employee who touches it to understand exactly what their business is about, and how it will impact on their respective 'customers'.

In implementing ERP without prior re-engineering, ERP could dictate the business process design, which could either be to the benefit or the peril of the company, depending on its specific circumstances.

Many projects start as a combined ERP and re-engineering project, and end up either implementing old processes or 'generic, out of the box' processes, due to budget and timeline constraints, and the complexity of ERP package implementation.

(iii) Implement ERP first; re-engineer afterwards from a stable base:

This has become an alluring alternative, especially with the new millennium looming. Companies see ERP as the opportunity to stabilise infrastructure problems and cost, eliminating complex interfaces between legacy systems never developed to talk to each other, while solving the millennium problem. The added benefit is then perceived to be the opportunity to re-engineer later from a stable base.

The biggest problem with this approach, apart from the costliness (in terms of both real and opportunity cost) resulting from automating old processes, is that companies almost always seem to underestimate the impact ERP will have on their organisations. This culture shock lingers for months, if not years after implementation. ERP software imposes major changes on the very nature of what people do. For example, it will transform order-entry clerks into business people, impacting on the company with every transaction they do.

Another downside of first implementing ERP is that the software cannot address operational inefficiencies that may arise due to policy or process flaws. The ERP solution works according to predefined policies and procedures. Operational processes need to be optimised before an ERP implementation takes place. This is the main reason why an ERP implementation project is typically preceded by a re-engineering exercise.

For the many companies implementing ERP without prior re-engineering, the approach should be to complete the implementation, stabilise the company and then perform re-engineering on selected processes, hopefully with the benefit of hindsight. The table below summarises these options.

Table 24: Summary of options

CLEAN SHEET BPR	BALANCED APPROACH	ERP DRIVEN APPROACH
Out of the box thinking	Best of both worlds	'Quick and dirty' approach Risk of generic processes
Clean slate	Use ERP as a road map	Risk of automating inefficient processes ERP dictates processes
Unattainable goals might be set	Shorter time to real benefit possible	Shorter time to systems resulting benefits
Could be difficult to set tangible goals	Continuity of project team and business representatives	
Rework to fit IT solution	Reworking could be limited or even avoided	
Time and resource intensive	Could have serious impact on business resources	

4.2.1 AN EVALUATION OF ERP SOLUTIONS WITHIN THE SCOPE OF BPR

Managers utilise scarce resources only if they adopt an enterprise-wide perspective. ERP, utilising packaged software solutions, enables organisations to integrate major areas of their business such as finance, distribution, sales plant maintenance and production planning.

Application packages have largely become a part of the average technology architecture. It is important to understand how these packages are selected and deployed, and what will be needed to integrate the software into existing environments.

The following are some of the major advantages of ERP packages [Pellissier and Kleynhans, 1999]:

- Faster and easier to implement than custom-developed systems or a mixture of best-of-breed solutions.
- Best practice business rules and workflow tend to be already implemented in the packaged application.
- Packages come with regular upgrades and support, enabling companies to keep up with new trends and statutory requirements (for example, the Eurodollar) and budget for maintenance as a stable cost.
- ERP packages have a positive influence on communication within a company – they force individuals, departments and functions to communicate.
- As mentioned before, they help individuals to realise their role in the larger organisation. Everybody touching the software has a 'customer' who will be influenced by it.

Disadvantages include [Pellissier and Kleynhans, 1999]:

- The temptation to engage in 'silver bullet' thinking (thinking the application would provide the complete solution to all the organisation's problems).
- A loss of in-house control over features and functionality.
- The inability to meet unique business requirements, or use information systems as a competitive advantage.
- Expensive and time-consuming to implement and stabilise within the organisation.

Implementing an ERP system is no easy task. A growing list of companies have tried and failed. Implementation requires 100% commitment from the sponsors and the project team, and continuous executive support to improve chances of success.

If ERP is correctly implemented, with clean processes driving the business, the results could be spectacular. Dell Computers and their DIRECT MODEL [Magretta, 1998] constitute a good example. Dell's success is partly due to the way they use

information to speed up execution of every aspect of their business. True virtual integration is the next step beyond the Dell model, and requires re-engineering with the complete value chain seen as one.

The following figure shows the evolution a company undergoes when utilising the best of ERP and re-engineering.

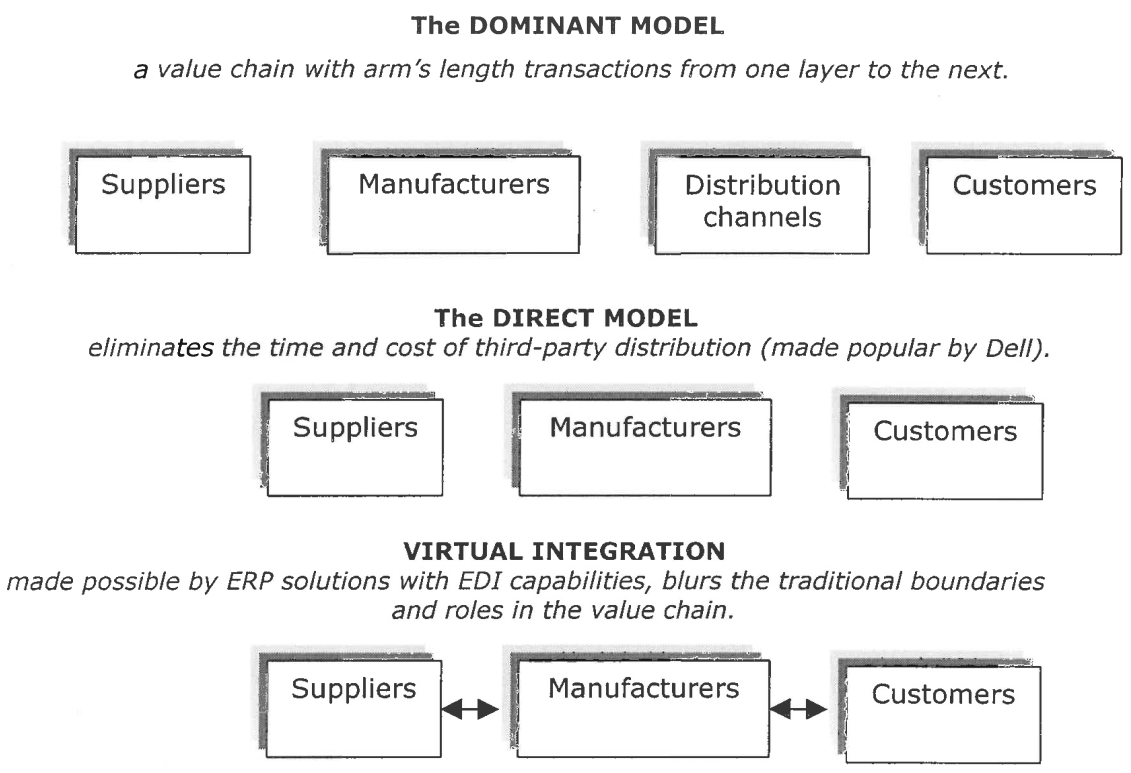


Figure 38: The evolution of a faster business model
Source: Magretta, 1998

This evolution is made possible by the successful combination of ERP and business re-engineering. It could be possible without the combination, but at substantially higher cost and risk of failure.

4.2.2 BPR AND ERP: A BEST PRACTICE COMPARISON

Carr, Henry and Johansson [1995] identified sixteen best practices that companies adhered to in order to make their re-engineering projects successful. These are listed below together with some comments regarding these.

Table 25: Summary of best practices

BEST PRACTICE	COMMENTS
Recognise and articulate an extremely compelling need to change	For most companies even considering re-engineering, there are very obvious and compelling needs to change. Out of control costs, falling profits and margins and many other reasons could be the incentive for this.
Start with and maintain executive-level support.	Strong leadership by the CEO is important, with buy-in from the executive level.
Understand the organisation's readiness to change.	Understanding the need for change is the easy part. The real challenge lies in determining how ready an organisation is for change, and adjusting the approach accordingly.
Communicate effectively to create buy-in.	Effective communication of decisions and motivations for decisions would play an important part in preventing too much negative political activity.
Create top-notch teams.	Form collaborative teams to address specific issues.
Use a structured framework.	
Use consultants effectively.	The correct use of consultants is a major determinant of the final cost and success of the change. A company's in-house skills and readiness to break away from the past, should be considered.
Link goals to corporate strategy	
Listen to the voice of the customer.	This should be true for both in-house and external customers.
Select the right processes for re-engineering.	Very important. Given the time and cost constraint, careful selection would be needed.
Maintain focus – Do not try to re-engineer too many processes.	Select the processes that really will reduce cost and affect customer service.
Maintain teams as the key vehicles for change.	
Quickly come to an AS-IS understanding of the processes to be re-engineered.	
Choose and use the right metrics.	Depends on the processes chosen for re-engineering.
Understand the risks and develop contingency plans	
Have plans for continuous improvement.	

After Carr, Henry and Johansson, 1995

Bancroft [1998] lists the following critical success factors companies have to adhere to in order to increase their chances of a successful implementation. Comments and interpretations are added.

Table 26: Critical success factors in achieving successful implementation

CRITICAL SUCCESS FACTORS	COMMENTS
Understand your corporate culture in terms of readiness and capability for change.	Similar to the best practice for re-engineering. The readiness is there, is providing the leadership and direction that is needed. The political culture of organisation should also be considered.
Begin business process changes prior to implementation.	
Communicate continuously with all levels of users in the business and set reasonable expectations.	Similar to the best practice for re-engineering on communication.
Provide superior executive championship for the project.	Similar to re-engineering.
Ensure the project manager is capable of keeping a proper balance between the technical, business and change management requirements.	Powerful, experienced leadership is critical. An independent consultant might have to be included in the management team to facilitate and add objective edge to the project management.
Choose a balanced team and give clear role definitions.	
Select a good project methodology with measurements.	Measurements should again tie in with the business incentives for completing a successful project.
Train users and provide support for job changes.	Change management would be very important.
Expect problems to arise, commit to change.	

Source: Bancroft, Seip and Sprengel, 1998

If one compares these critical success factors with the best practices for re-engineering discussed in Table 25, there are substantial similarities. The software solution under discussion (and the same applies to similar solutions) is known to trigger re-engineering in order to enable implementation. As a general guideline, minor process adjustments could be done while implementing the system, but large-

scale engineering should be done before implementation. It is advisable that the re-engineering team should receive some level of training on the system structure, and that at least one high-level initial design be completed of a proposed architecture within the business. Also, at least one systems specialist should be included in the re-engineering project team to help prevent re-work as far as possible. Re-engineering after the system implementation is not advisable, as the system has a strong learning curve and some stability is needed in order to give users a chance to adapt. [Refer to Figure 28.]

The following factors should be borne in mind during implementation [Pellissier and Kleynhans, 1999]:

(i) *The time constraint due to the millennium problem:* This is discussed in Pellissier and Pienaar [1999] and, since it is considered a once-off, will not be repeated here.

(i) *The time needed to implement the integrated system:* It takes a long time to implement large integrated systems successfully. It also takes a substantial amount of resources to implement them. The timeline issue is generally one of the biggest influences on a decision regarding ERP and/or re-engineering. The more immediate risk of having key resources focusing on anything but their most immediate responsibilities for an extended period of time is often of great concern to companies. Add to that the rapidly changing environment companies operate in, and one is even more aware of the need for integrated solutions.

(iii) *The political minefield:* Change brings uncertainty. Uncertainty is a breeding ground for unwanted political activity that could further strain limited resources. Project management, change management and communication are key areas often neglected for either or both of the re-engineering and ERP projects.

(iv) *Unanimous executive sponsorship*: Different opinions regarding the value of ERP and re-engineering are to be expected on every level of the organisation. Top management is no exception. To enhance the chances of successful change of the magnitude ERP or re-engineering dictates, the unanimous support of the executive level needs to be gained, made visible and communicated to the entire business.

4.2.3 CONCLUSION

Re-engineering is never without its risks. The same holds true for implementing large, integrated systems into large, complex organisations. The opportunity to see both work in tandem could deliver significantly positive or significantly negative results.

None of the above alternatives provides the perfect solution, since there is none. On the other hand, by studying these, some guidelines surface that may obviate wasted effort.

Organisations that have been successful in implementation have picked a few key processes that needed improvement, redesigned these with the SAP solution in mind, and subsequently configured SAP to support the new process designs.

The following may serve as guidelines:

- In the alignment of IT with the business, keep to a holistic approach.
- Successful ERP projects should be treated as *business projects*, rather than IT projects.
- An important underlying reason for companies implementing ERP systems, is management's desire to bring discipline into the organisation. ERP is consequently used to drive the re-engineering focus. The software acts as a template or road map for the re-engineering.

The following steps could help determine a balanced approach:

1. Make key strategic business decisions regarding processes before starting any re-engineering or ERP implementation; agree on the core business and processes supporting them.
2. Decide, at least in principle, on what role IT should play in a final solution (for example, best of breed, in-house developed or packaged solution).
3. Become familiar with high-level opportunities and constraints (SWOT analysis if necessary) the preferred IT solution(s) would provide the company with.
4. Perform needed process review, redesign or total re-engineering, while keeping the opportunities and constraints of the previous point in mind.
5. Implement the IT solution that best supports the business.

Given these, a hybrid approach is suggested. Approve one project, containing a re-engineering component and an ERP system implementation component, but not done simultaneously. Given the similar phases and steps needed for both re-engineering and system implementation, a streamlined project under one project manager with the following phases is proposed. Timelines will vary given the unique circumstances and resources available for companies, but a possible average timeline is suggested in the following table.

Table 27: Project management timeline for BPR/ERP implementation

PHASE	DURATION	COMPONENTS
Detailed Analysis of AS-IS and scoping	2 months	Re-engineering and system implementation
Re-engineering phase and initial high-level design	4 months	Re-engineering with system inputs
Detailed Design	3 months	System implementation
Construction phase	3 months	System implementation
Implementation and Cut-over	2 months	System implementation

Source: Pellissier and Kleynhans, 1999

A balanced approach is needed - one that will balance the risk of 'narrow' or 'ERP-channeled' re-engineering with the risk of rework when trying to implement rigorous 'white-paper' re-engineered processes using ERP systems.

4.3. THE CASE AGAINST IT

The BPR devised by Hammer and Champy [1990] heralded IT as the enabling mechanism that allows corporations to reinvent themselves. IT was deemed the enabling technology at the core of what re-engineering promises to achieve. The redesign of work processes, elimination of processes with little or no value and the overall redesign of the organisation depend heavily on the existence and support provided by IT. Since the authors provided only cursory description of *how* IT should serve as the engine for the proposed change, it was left to the organisations themselves to determine how this should be done. In this process, various tools and publications have been born.

According to Hammer [1990], the usual methods for boosting performance (process rationalisation and automation) have not yielded the dramatic improvements companies need. In particular, heavy investments in IT have mostly delivered

disappointing results – largely because organisations tend to use technology to mechanise old ways of doing business, leaving the existing processes intact and simply using computers to speed up the processes. However, speeding up the processes cannot address the fundamental performance deficiencies. Many job designs, work flows, control mechanisms and organisational structures came of age in a different competitive environment and before the advent of the computer. These are still geared towards efficiency and control, whereas the watchwords for the Information Wave are innovation, speed, service and quality. Hammer [1995: 104] himself believes:

'It is time to stop paving the cow paths. Instead of embedding outdated processes in silicon and software, we should obliterate them and start over. We should .. use the power of modern IT to radically redesign our business processes in order to achieve dramatic improvements in their performance.'

The fallacy in Hammer and Champy's [1990] initial contention is composed of two major dimensions [refer Module I] that help to explain the inherent failure of BPR as a comprehensive cure for organisational problems. These are [Geisler, 1997]:

- The value of information as a component in critical decision-making and
- the evolution of IT in the organisation.

(i) *The value of information:* Supporters of BPR and IT claim that the fact that there is new, accessible, adequate and sophisticated technology available to transfer, store and retrieve information, finally allows organisations to exercise BPR and to exploit its promised advantages. However, IT is only the technology that carries information faster, better, more of it more clearly and that allows for more sophisticated manipulations. (This notion does not in essence support the idea of re-engineering as a form of crisis management.) More and more there is a realisation that the introduction and proliferation of IT in an organisation is not enough to drive re-engineering or to assure its

success. This leads to the following rationale for IT's failure to promote re-engineering:

- Even the best, timely, correct and clear information is not enough to fuel re-engineering and
- If re-engineering is already flawed as a concept and major change programme, IT and the ubiquity of information will not overcome these flaws.

Thus, IT may have a stronger effect in changing the way business is conducted and organisations behave, than as a dynamic force in re-engineering. It simply does not have the capability to salvage a programme of change if the other dimensions of re-engineering are flawed. If re-engineering as a concept is feasible and produces positive results with few side-effects, then IT may serve as the technology that facilitates the execution. However, if the re-engineering is already flawed, not even the best information can save an ailing effort.

(ii) *The evolution of IT:* IT itself has undergone a fundamental change and is continuing to do so. IT has changed from being a back-room data-processing process used by IT professionals to being a fundamental strategic tool (if used appropriately) employed by knowledge workers in the organisation.

Hence, if Hammer and Champy [1990] regard IT as a very powerful force that already exists in organisations and their BPR scheme is designed to take advantage of this powerful technology, they may be correct. This will depend on the type of IT involved and it is suggested here that this cannot be generalised. This notion will be explored elsewhere in the thesis. The different IT (information delivery systems) were summarised in Figure 19.

4.4 RAMIFICATIONS OF CULTURE ON TECHNOLOGY - IMPLICATIONS FOR BPR

Adler [1990] reviewed changes in workforce skills, work procedures, organisational structure, strategy and culture, all of which have to be in place for IT to realise its full potential. In particular, culture is identified as frequently affecting design efforts, although its nature and implications typically are not understood to provide a proper knowledge base for future planned culture change.

The notion of culture as a barrier to change has already been explored in this thesis. What is at issue here is the link between culture and process integration. Thus, according to Baba, Falkenburg and Hill [1996], three interrelated forms of culture influence organisational thinking about IT and its use:

- National culture,
- organisational culture and
- work culture.

These will be explored here with reference to the internal and external integration process.

(i) *National culture* is a distinctive pattern of ideas and behaviour of the people residing within the territory of the nation state.

(ii) *Organisational cultures* are subcultures within a nation state that derive from the corporate founders and evolve through the learning experiences of the organisation.

(iii) *Work culture* is often dominated by the perspective of a particular discipline such as engineering. It takes shape below the apex of the organisation, where work group members share common tasks over relatively long periods of time.

The national culture has the most profound and pervasive influence on behaviours and beliefs. In a South African context, this is of special concern, since the World Competitiveness Report rates this country 16 in terms of 'development and application of technology' [World Competitiveness Report, 1998], however, in terms of 'Science, technology and youth' the country rates 46 (out of 46). This variance negatively reflects on the country's future in technology-related issues.

The heterogeneity of the South African society contributes to and is itself a product of the inherent lack of shared values and subsequent lack of autonomy and inability to transfer organisational learning across units. (In contrast, Japanese homogeneity enhances the Japanese ability to perform since Japanese organisations share a commitment to excellence – called '*ningen kankei*' or degree of closeness and co-operation). (Refer to Figure 28 for organisational cohesiveness.) This results in little if any integration of computer systems within and between organisations (for example, the use of two similar information delivery systems in Siemens Ltd). It also causes new leaders to dismantle work processes and/or computer systems implemented by predecessors to show their autonomy.

The issue of autonomy lies at the heart of process redesign since one of the major reasons for the redesign in the first place is the undisciplined proliferation of methods, whereas design and integration requires commonality, in this sense sharing common principles and utilising common hardware and software. Thus, integration, in this sense, requires information sharing, which becomes more pronounced when the exchange of information is across organisational boundaries. One example of this is the concept of buy-in in the notion of EDI principles.

In South Africa, most organisations exist in a national context (although some may originate as part of multinationals), which shapes the thinking and actions of leaders. Notwithstanding this, several factors combine to make each organisation distinctive. These include:

- *Founders and employees* – bringing a unique set of expectations and values to the organisation.
- *Operational environment* – industry, region and time specific.
- *A unique history* - that is the spontaneous responses of a group to critical historical events, for instance the radical shift in Government in South Africa over the past decade.

An important issue is that of the linkage of suppliers and/or customers through the use of IT. This is discussed below.

A certain South African organisation recognised the need for improved international competitiveness. To speed up the introduction of new products, they launched a major redesign of their product development process, including the need for integration and homogenisation of product development across a range of internal functions and external suppliers. A set of technologies was deployed that would share data through a common product database. However, the internal divisions and external suppliers, accustomed to operational autonomy, balked at the notion of a common product development process. In desperation, leadership subsequently concentrated their efforts on new IT deployment. They urged internal divisions and external suppliers to adopt the common set of tools which they believed would improve communication – even if core processes remained heterogeneous. However, members did not buy into the new IT, agreeing on the value of the IT as a strategic tool but disagreeing that it could enhance their jobs on an operational level.

On the supply side of the organisation, the following occurred. Supplier A responded with enthusiasm to the new IT and immediately bought into the task of process analysis, redesign and new IT implementation, thereby becoming the first unit (inside or outside the organisation) to complete a full integration of the common system. Within one year, they had implemented modeling in design areas and were engaged in process re-engineering. Users were positive about the solid modeling

technology and new work system and noted no major problems during implementation.

Supplier B presented a vastly different picture. Three years after initiation, they still had not converted and resistance took the form of time and cost studies (proving the conversion harmful) repeated delays of implementation dates and interference with ongoing pilot studies of the IT investment.

The different responses of the two suppliers may be attributed in part to their organisational cultures. This is discussed below.

Supplier A has historically been a technology leader involved in movements of the global environment, achieving recognition in the past for its product technology. Out of this, a culture of innovation arose, with management policies and procedures supporting high-risk technology ventures and encouraging technological change. This culture of innovation spread to the process arena, since top management encouraged its members to stay abreast of new process tools and absorb state-of-the-art process technologies. It had a diversified customer base in which product and process innovation played a key role. It had recognised early on, that solid modelling technology for product design and manufacturing was necessary for sustained technological leadership. It also believed that closer collaboration with key customers would be necessary to meet customer requirements in terms of cost, quality and timing. It took the organisation's requirement of integration as an opportunity to improve its relationship with that organisation and to attract other customers as well.

Supplier B, on the other hand, had a reputation for designing and delivering components quickly with minimal staffing requirements. Members saw its competitive advantage as based on a culture of speed. The requirement of process integration was perceived as ruining their reputation in this regard. Instead of pushing their designers to keep abreast of technological change, they declined early

opportunities to update design tools, making the required change difficult to absorb. Its relationship with the mother organisation allowed its culture of speed to flourish, despite the negative implications of this for product quality. Unlike its counterpart, it was a captive of the mother organisation, the latter being its largest and only major customer. Since supplier B did not compete internationally, it was not exposed to the same competitive pressures as supplier A. Undisturbed by external pressures, supplier B could retain its old policies, beliefs and technologies. The mother organisation's shift represented an abrupt break with tradition, neither understood nor accepted by supplier B.

The above case study on the role of culture in technology-enabled integration reveals different aspects of culture. (Refer to Figure 32 where the three pillars of organisational change were discussed.) Firstly, the mother organisation displayed the classic case of a culture of autonomy, in which divisions functioned independently so long as they remained financially successful. This undermined any notion of homogenised processes critical to strategic competitiveness. Supplier A displayed a passion for technology, displaying a culture of technology innovation and organisational learning. Supplier B did not display this passion for technology, its culture (of speed) having been developed through years of relative isolation. They showed a willingness to sub-optimise performance in order to achieve their own performance goals. The environment also played an important role in shaping the different routes taken by suppliers A and B. Exposure to global competition enabled supplier A to transcend some cultural limitations, whereas supplier B's insularity exacerbated the individualism of its sub-units.

Organisational culture is thus subject to powerful influences from a larger cultural environment. An orientation towards the global marketplace appears to shift the level of external influence from national to international, meaning that the cultures of global organisations will probably affect a wider range of different national cultures.

It is suggested that the following principles be adhered to in optimising the convergence between culture and IT and developing a culture of technology innovation – all of which are relevant to BPR:

1. Expose internal groups to external environments.
2. Link top-down and bottom-up change.
3. Recognise that training is necessary but not sufficient.
4. Redesign core work processes.
5. Form cross-functional teams.
6. Identify the anti-champions.
7. Optimise the strength of culture.

In conclusion, in order to compete effectively in new markets, organisations should redesign basic processes, integrating these with new IT. Culture can play a positive or inhibiting role in this venture.

Following from the earlier discussion (Section 4.3) on the evolution of IT and the value of information to explain BPR's failures, the subsequent section will develop a case against BPR.

5. THE CASE AGAINST RE-ENGINEERING

By all accounts, BPR is in trouble. According to one American survey, companies will spend $52 billion on business re-engineering, of which $40 billion will go towards information technology. It seems that organisations are not satisfied with the re-engineering label.

Whether BPR is called process innovation, business process redesign, business engineering or process engineering, organisations are trying to make radical and dynamic changes in the ways they operate. At the heart of BPR are two concepts.

These are:

- Organisations should view themselves in terms of processes (not functions, divisions or products) and
- organisations should think inductively instead of deductively.

The latter refers to the constant disruptions to the current ways in which they conduct their businesses. The proliferation of new IT is increasingly becoming a major contributor to this disruption. The table below summarises business rules that have become redundant through the power of IT.

Table 28: Disruptive technologies

RULE	DISRUPTIVE IT
Information can appear in only one place at one time	Shared database
Only experts may perform complex work	Expert systems
Businesses must choose between centralisation and decentralisation	Advanced telecommunications networks
Managers make all decisions	Decision support tools (database access, modelling software)
Field personnel need offices where they can receive, store, retrieve and transmit information	Wireless data communication and portable computers
The best contact with a potential buyer is personal contact	Interactive communication
You have to find out where things are	Automatic identification and tracking technology
Plans get revised periodically	High-performance computing

Source: Hammer and Champy, 1993

The management fad of the moment, BPR, is well advanced in its cycle. Intended to boost competitiveness through simpler, leaner, more productive processes, re-engineering is rampant in labour- and capital-intensive industries (such as cars,

telecommunications, drugs and aerospace); it has spread to the service sector, particularly insurance and banking.

One group of critics argues that re-engineering is merely an elegant word for relabelling. Its key ideas - putting customers first, using teams, empowering workers, rewarding performance, tearing down divisional walls - have been conventional wisdom for two decades. Another group argues that re-engineering simply is not practical. According to one widely quoted estimate, 85% of re-engineering projects fail. It seems that companies are putting themselves through an enormous amount of pain for little or no gain.

It seems unusual that the first assessment of BPR comes from a leading re-engineering consultancy, namely, the CSC Foundation Index. Based on a survey of 497 large companies in the United States and another 124 in Europe, the report confirms that re-engineering is immensely popular: 69% of the American companies surveyed, and 75% of the Europeans, are already re-engineering, and more than half of the rest are thinking about it. The report admits that re-engineering is a disruptive process, but plays down job losses, which it says amounted to an average of just 336 in each of the initiatives in North America and 760 in Europe. More unexpectedly, it admits that re-engineering is far from being a guarantee for corporate renewal. Fewer than half of the organisations achieved the increased market share they planned for. Moreover, some re-engineering attempts failed abysmally [CSC Foundation Index, 1994].

Gemini Consulting reports that

> '*..seven in ten companies that have undergone re-engineering, expect to spend just as much on such initiatives in the future.*'

They go on to state that, of the 782 organisations investigated, about 75% of the executives conceded that their organisations had succeeded in reducing operating

expenses and increasing productivity; whilst only 47% believed that they had succeeded in generating revenue growth and 37% succeeded in increasing market share. What is more, only about half of the executives interviewed during the investigation, believed that their companies knew how to measure the impact of their re-engineering programmes. Gemini suggests that unless organisations close some significant gaps between their expectations from re-engineering and the reality, such efforts will fall short [Moser, 1997]. The study also investigates the contradictions between what executives say they want to change about their business, and what they are able or willing to do. Although 90% agree that

'.. technology is a critical enabler
of our organisation's re-engineering efforts ..',

whilst only 41% agree that

'we are good at managing the deployment of
our IT resources against our re-engineering initiatives.'

Other gaps identified in the research are:

- *Corporate culture*: Two-thirds of the respondents reported that changing the organisation's culture is a major component of re-engineering, whilst only 8% ranked changing the organisation's structure among the top three priorities – thus missing the link between culture and structure.

- *Customers:* Although 84% of executives agreed that they know their customers' needs and re-engineer the processes to meet these, only 64% reported that their customers are helping them to redesign the processes.

- *Supply chain:* Fewer than half of the executives reported that their suppliers were helping them to redesign their processes, while only 28% said that their distributors did.

Since the supply chain is the biggest organisational money drain, organisations are squandering a ready resource of expertise in improving the business. Moreover, with the growing notion of outsourcing, vendors are possibly more involved in an organisation's business than ever before.

In an interview with Hammer [Mullin, 1996], he discusses the simple shift beyond re-engineering. He retains his old definition of re-engineering but the emphasis shifts from the word 'radical' (connoting clean sheet design) to 'processes' (representing the aspect of the organisation that is redesigned). He believes it should be recognised that there are two distinct but related ideas – the one of aligning the organisation around processes and the other of instituting major changes in how processes operate. In this context, Hammer believes that the ratio of workers to managers could double. This notion stands in contradiction to the idea that automation (using technology) can decrease the numbers of workers.

Critics of re-engineering believe that the inherent problem of the concept lies not so much in IT's inability to do the re-engineering, as in the misleading label that in no way defines what it is, rather what it is *not*. They maintain:

'The case against re-engineering is continually handicapped by its unfortunate and technocratic label which does not in any way suggest what is it all about. The label itself is neutral, directionless, purposeless and therefore misleading.'

Editorial, Human Systems Management, 1995: 105

From the first CSC Foundation Index [1994] studying the success (or failures) of re-engineering, the most important theory to emerge (corresponding to other, similar

studies) is that re-engineering is not enough on its own. It needs to be linked to strategy. They pose the question:

'Why streamline a particular business when technology is about to render it obsolete?'

Managers need to reflect on *what they are doing* as well as *how efficiently* they are doing their business. For example, contracting out may be more sensible than reorganisation; switching to a new business may be more sensible than simply doing the old one more efficiently. It is clearly time to re-engineer the re-engineers.

Hammer himself presents a different viewpoint in his subsequent book [1995]. He contends that many organisations misinterpreted the message and used re-engineering as an excuse to slash employee numbers. He strongly suggests that, after an organisation has trimmed off the fat, they should re-engineer for growth. He goes on to say that organisations should follow through by focusing on products, customers and market share – going beyond re-engineering. This proposes an evolution of re-engineering as business evolves with it. Its gurus are unanimous that the problem with re-engineering lies in its unflinching focus on the bottom line [Cowley, 1995]. They believe that redesigning processes as a cost-cutting measure is counterproductive since a lot of valuable knowledge and information are simply discarded. The fact that Hammer himself is *re-engineering* re-engineering proves this more than anything else could.

5.1 MOVING FROM THE 'FUNDAMENTAL', 'RADICAL' AND 'DRAMATIC' TO PROCESS INTEGRATION AND KNOWLEDGE

Hammer and Champy themselves were compelled to publish 'What Re-engineering is not' [1993]. They maintain it is not any of the following:

- Downsizing,
- automation
- restructuring
- reorganising
- debureaucratisation
- delayering
- total quality management or continuous improvement, or
- mass customisation.

The essence of re-engineering is *process integration*. It is true that process integration is partially a spontaneous process, taking place all the time and everywhere in response to the extremes of specialisation and the division of labour. However, partially, it is also an engineering process. In this, Hammer and Champy [1993] describe re-engineering as

> ' .. *the idea of reunifying* (previously: breaking down)
> *those tasks into coherent business processes.'*

They go on to write that re-engineering rejects Adam Smith's industrial paradigm – the division of labour, economies of scale and hierarchical control. However, they still fail to provide a more useful definition of re-engineering than the one presented in 1990 and mentioned earlier in this module. They maintain that their definition contains four key words, namely 'fundamental', 'radical', 'process' and 'dramatic'. However, it is suggested that there really is only one key word, namely *process*. The essence of re-engineering has little to do with the other three, but totally focuses on re-integrating the process – in terms of tasks, labour and knowledge. This will be explained in the table below.

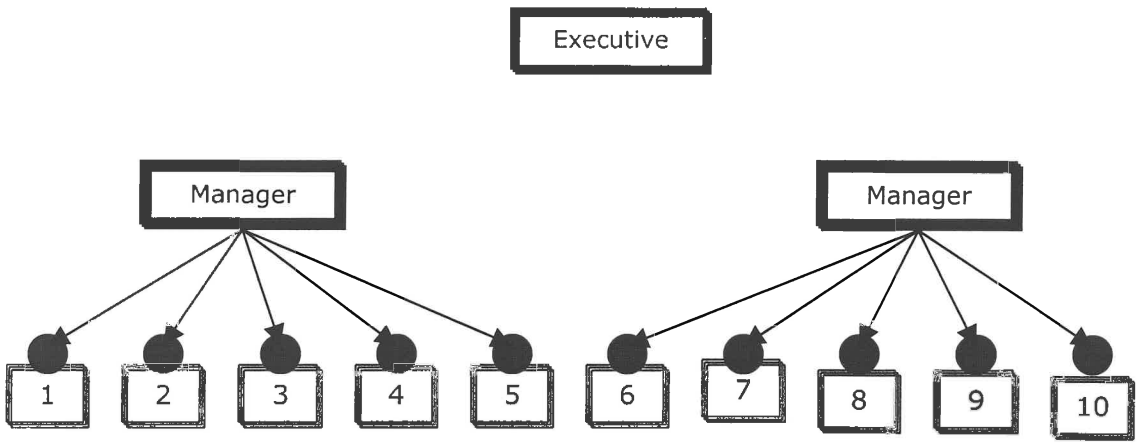
Table 29: The main focus of re-engineering – re-integration of processes

PROCESS RE-INTEGRATION	HOW THIS IS ACHIEVED
Reintegration of tasks	Combine smaller processes into larger integrated units. Reduce number of parts in products and processes.
Reintegration of labour	Allow workers to perform and co-ordinate larger portions of the process. Encourage multifunctionality and co-ordinate autonomous teams.
Re-integration of knowledge	Workers must know larger portions (not smaller ones) of the process and product.

After Zeleny, 1995

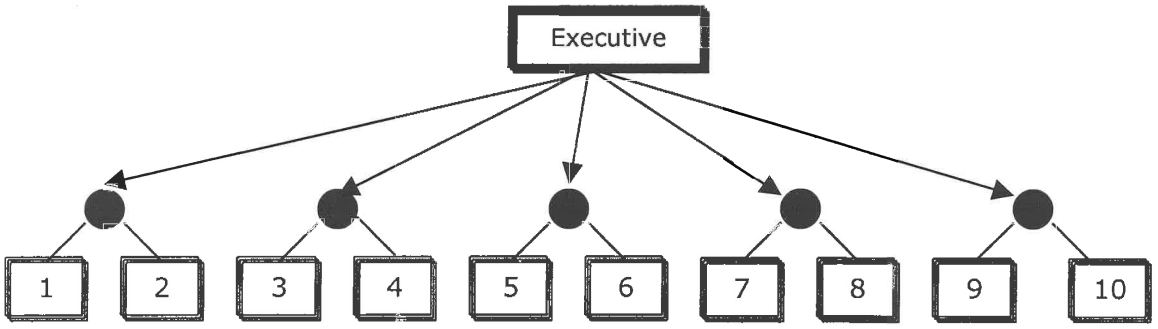
Thus, the re-engineering solution deals with at least three separate and relatively independent and differentially manageable aspects, namely divisions of task, division of labour and division of knowledge. The following figure depicts the problem with the division of labour and the subsequent solution, the re-integration of labour – with the aid of technology.

(a) Problem: Division of labour, task and knowledge and



Increased productivity, however, increased complexity and cost at a faster rate because of limited span of control of the individual.

(b) Solution: Subsequent re-integration thereof (using technology).



= *worker*

Each worker performs two tasks instead of one (using requisite technology), task productivity is maintained, number of workers and managers reduces, whole operation is simpler, more streamlined, cheaper, more flexible and of a higher quality.

Figure 39: The re-engineering of a process – unquestionably fundamental, radical and dramatic
Source: Human Systems management, 1995:107

Zeleny [1995] likens the existence of re-engineering to the example of the move from horse carriage to combustion engine. Continuously and incrementally improving the components of the horse carriage has limited scope and is useful only in preserving the status quo. Re-engineering the horse carriage (fundamentally, radically and dramatically) is not enough. The focus has to be on the reintegration of task, labour and knowledge of the product or service. This is also true for management systems. The task is not to improve a hierarchical, centralised command system (fundamentally, radically and dramatically), but to re-integrate the processes of autonomous process-owners.

It has been estimated that two-thirds of re-engineering projects fail. Reasons for these will be discussed in the following section.

5.2 THE MOST FATAL RE-ENGINEERING MISTAKES

The following is a brief summary of the reasons for BPR failure as discussed in the literature on the subject. These are mentioned here without in-depth discussion, since, apart from the IT relevance, they generally fall beyond the scope of this thesis.

(i) *Unclear definitions:* BPR is more than automation or re-organisation although it almost always effects organisational change. It goes beyond TQM seeking breakthrough measures of performance, pursuing multifaceted improvement goals, for instance quality, cost, flexibility, speed, accuracy and customer satisfaction – concurrently and with little trade off.

(ii) *Unrealistic expectations:* One of the consequences of (i) above, is the over-optimistic viewpoint about the domain of BPR.

(iii) *Inadequate resources:* Adequate resourcing of the BPR is a balanced mix of insiders and outsiders for the re-engineering. The question of IT resources also plays a part in this.

(iv) *Taking too long:* Although it is generally contended that re-engineering projects may take anything from three to five years, few executives are that patient and few organisations can sustain themselves that long – particularly if the re-engineering is done from a reactive/pre-active perspective.

(v) *Lack of sponsorship:* In conjunction with (ii), BPR cannot be driven from a supply chain perspective, it needs buy-in from top management – more so since it generally entails culture changes.

(vi) *Wrong scope:* It is not possible to re-engineer an organisation, it is only possible to re-engineer its processes, with many processes being inter-organisational and cross-functional (See Section 7 of this module). The likelihood of success diminishes if the scope of the BPR is restricted to certain processes only.

(vii) *Mysticism:* BPR is not a paradigm shift, it is an engineering discipline that enables transformation to take place.

(viii) *Lack of effective methodology:* Without some scientific approach, the BPR may consist of an AS IS without a proper TO BE scenario. One proposed BPR model consists of four phases, namely analysis (AS IS), design (TO BE), transformation and evaluation.

(ix) *Technocentricism:* As this concerns the focus of this thesis, it is important to note that implementing IT (although radical by nature in terms of the applicable software delivery system) and implementing BPR are not the same– their objectives being different. In this regard, the reader is referred

to the software delivery matrix and the proposed Technology Change Model [Figures 19 and 34 respectively]. Most journals refer to this as the 'Keeping up with the Joneses effect'.

5.3 CONCLUSION

5.3.1 THE PROCESS RELEVANCE STRATEGIC GRID

In Module IV, mention was made of the IT Strategic Grid as an instrument to evaluate the relevant importance of the IT investment and its linkage to the overall strategic purpose of the organisation. In the schematic presentation in Figure 40 below, called the Strategic Relevance Grid, the IT Strategic Grid in Module IV is transformed in terms of processes (current and proposed).

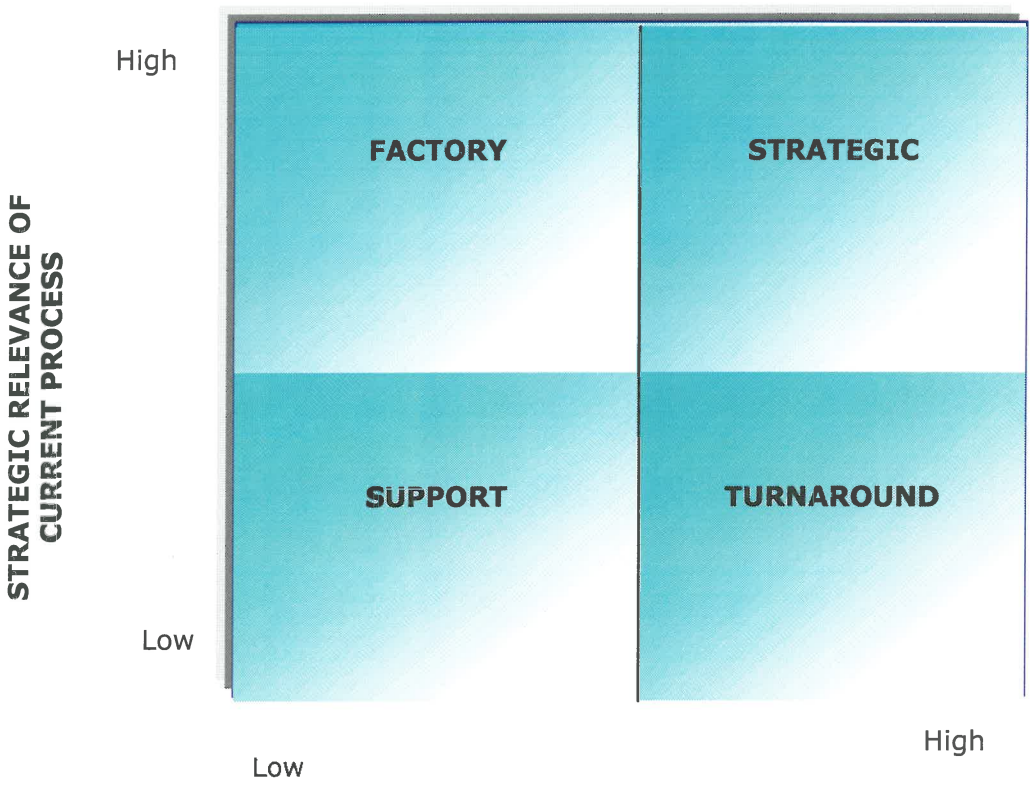


Figure 40: Strategic Relevance Grid
Source: Revenaugh, 1993

The first dimension in the transformed grid portrays the strategic relevance of the current processes (low to high), while the second dimension portrays the strategic relevance of the proposed re-engineered processes (low to high), with the labels in the quadrants unchanged from the IT Strategic Grid. The rationale behind the study of processes is simple: Since a major factor in BPR is not only to improve old processes, but to significantly alter, or even replace, the existing processes, the current processes should be accurately described before any changes can be suggested. The dimensions of the Strategic Relevance Grid are discussed below.

(i) *Processes in the strategic quadrant*: Both current and proposed processes in this quadrant are ultimately important. Implementation of the re-engineered process is particularly critical and is deemed absolutely essential for the long-term survival of the organisation. Consequently, these processes require maximum commitment and the re-engineering campaign should address these urgently.

(ii) *Processes in the turnaround quadrant:* These are critical to improvement of the business performance. Current processes are acceptable but not considered strategically relevant. The proposed re-engineered process is strategically relevant and is expected to produce better performance and/or competitive advantage. Thus, the benefit of the proposed re-engineered process should be communicated clearly and the re-engineering campaign should start soon.

(iii) *Factory and support cell processes:* These processes should be re-evaluated for re-engineering. The nature of re-engineering suggests dramatic improvement in organisational performance. Even if the proposed re-engineering process itself is not strategically relevant, the results of the process (improved efficiency, improved effectiveness, decreased costs) should be strategically important. Since support quadrant processes are not strategic (and are not expected to be), it will be particularly hard to convince employees of the need for the proposed re-engineered process.

5.3.2 THE LINK BETWEEN THE STRATEGIC RELEVANCE GRID AND ORGANISATIONAL CULTURE

The focus of this thesis is not a study of organisational culture. However, as already mentioned, no change programme (IT or BPR or any other) will be successful unless the organisational culture acts as an enabler of (as opposed to a barrier to) change (see Figure 32). In the subsequent paragraphs, a framework will be suggested for the link between the Strategic Relevance Grid and corporate culture. In the

subsequent tables [Table 30 - the BPR Grid - and Table 31 – the Culture Re-engineering Grid] below, the implications of BPR are summarised firstly without culture as the first variable, and subsequently, with culture as the first variable. It has already been stated that although this is not the preferred course of action, most organisations tend to jump the curve from a reactive (as opposed to a pre-active or a pro-active perspective). Hence, the stronger the perceived need for change, the more likely the success of the BPR exercise.

Table 30: BPR implementation without considering culture

STRATEGIC RELEVANCE GRID	BPR IMPLEMENTATION SCOPE
Strategic	Considerable
Turnaround	Difficult
Factory	Difficult
Support	Persistently demanding - especially in an annoying unreasonable way

After: Revenaugh: 1993

Table 31: BPR implications considering culture

CULTURE	STRATEGIC RELEVANCE GRID	BPR IMPLEMENTATION EFFORT
Process	Strategic	Demands exceptional effort
	Turnaround	Demands exceptional effort
	Factory	Persistently demanding - especially in an annoying unreasonable way
	Support	Difficult
Work hard/Play hard	Strategic	Difficult
	Turnaround	Persistently demanding - especially in an annoying, unreasonable way
	Factory	Considerable
	Support	Persistently demanding – especially in an annoying, unreasonable way
Bet your company	Strategic	Able to perform without great effort
	Turnaround	Able to perform without great effort
	Factory	Moderate
	Support	Considerable
Tough Guy/Macho	Strategic	Difficult
	Turnaround	Difficult
	Factory	Demands exceptional effort
	Support	Demands exceptional effort

After: Revenaugh, 1993

In conclusion, the 'popularity' of BPR is a signal that organisations perceive the need for improved performance. From Hammer's perspective [1995], this entails an on-going process rather than a once-off cure. Thus, it is important to implement the BPR with the minimum scope for failure. Most authors maintain that in order for BPR to be a success, the strategic relevance of a specific process must be assessed and

the culture qualified, both of which are combined in the above model. With research pointing to the many failures of BPR implementations, it is important for organisations to address the cultural imperative as one of the key variables in the implementation of radical change. Thus, the individual and combined impact of culture and strategic relevance could resolve some of the BPR challenges that organisations are facing today.

6. DE-ENGINEERING THE CORPORATION

By its very definition, the term *de-engineering*, implies a self-organising pattern for leaders and workers. Wheatley [1994: 20] contends:

> *'Re-engineering is the supernova of our old approaches to organisational change, the last gasp of efforts that have consistently failed.'*

She adds

> *'Re-engineering is the biggest and most dramatic bandwagon that has hit the business and organisational world in along time.'*

She agrees that it is necessary to fundamentally redesign bureaucratic organisations, but that the net effect is a string of failed change efforts over the years. There is a growing concern in the literature on the subject that re-engineering is another attempt, usually from top management, to impose a new structure over the old and to take one set of rules and impose them on the rest of the organisation. It presupposes that one can design a perfect solution, whereas the 'machine' will subsequently comply with the new set of instructions. The question remains: What happens when the organisation needs to change again? One asks this because with re-engineering there is little attempt to institute ongoing workable processes for creating positive change. With *de-engineering*, the question shifts to

'Has the organisation's capacity to change increased and improved? Have we developed an organisation that can continue to be responsive and adaptive or have we created a new structure that will atrophy as the environment shifts?'

Wheatley, 1994: 20

The *de-engineering* phenomenon then is built on the premise that there is natural order and that patterns do exist (refer to Module II on chaos theory and the subsequent module on the chaordic enterprise), arising without any management at all and without any pre-engineered design. The contention is that any programme of change that tries to impose a structure on everyone, works against people's natural tendencies (but without their involvement). It has already been stated in Module III that people have a natural tendency to create order as needed - provided that certain conditions are present. In this context, the two major resources of organisations (the people and the information) need to work coherently. Organisations need to merge the science of management and leadership with the modern studies of complexity so that people may work in an information rich environment. Organisations use the term C^4I reflecting Command and Control in the first two Cs and supplemented by Communication, Computers and (business) Intelligence (refer to Module IV).

Thus, *de-engineering* entails a new definition of leadership, where the traditional leader may not even be present during a crisis and the role of the chaordic leader prevails. The challenge is to move information through the organisation without knowing ahead of time who will need what or where it may be needed. This addresses the vital issue of value and use of information discussed in Module I and in Module V, since it imposes leadership on employees using appropriate information at the appropriate time – thus moving the level of autonomy to where it might have maximum effectiveness.

In this context, it is important that organisations clearly define what the organisation is trying to achieve and how people should behave, given a particular situation. Thus, from the notions of chaos (Module II), it is possible to create well-ordered and efficient organisations that will be able to constantly change their physical structure, by creating an awareness of the creation of conditions for the order of the organisation to emerge and change. This is the new challenge: Order and answers do not come from consultants, management programmes or the external environment; people are able to create the answers and the order needed, provided that there is available, accessible and timeous information and that decisions can be made at the local level based upon a strong sense of organisation identity. It is suggested that these points make organisations truly agile, adaptive, versatile and resilient.

The difference between this approach and re-engineering lies in the fact that re-engineering assumes that the solution for failing organisations will come from some group of experts or consultants, whereas, *de-engineering* supposes that the organisation has access to its own intelligence and that conditions exist that support the use of that intelligence. Within this proposition, it is possible for the organisation to change continuously and organisations become living entities rather than well-tuned machines. In *de-engineering* the supposition is that people are involved – not only the re-engineering teams. In fact there is a meaningful involvement of the entire organisational force. It is still important to fundamentally redesign how organisations do their work, thus not only radically changing the organisation's structures, but also creating an organisation capable of and committed to a next round of change.

Wheatley's [1994] contention is that all approaches to change have been based upon a scientific model, generally the engineering sciences. The flaws in this approach are suggested as:

- The lack of questioning every assumption about making the organisation effective, and
- the lack of commitment to search for fundamentally new approaches to organisational learning.

6.1 DE-ENGINEERING AS NEW SCIENTIFIC MANAGEMENT

It follows that there is a new framework of understanding businesses in the light of the problems they face. It is interesting to note that problems often crop up seemingly spontaneously in widely separated places or arise in several disciplines at once (synchronicity). For example, at about the same time that Darwin proposed his evolution theory, Alfred Russel Wallace in Malaysia published similar ideas. At the time that the 16th century Dutch school of painters were drawing light for its effects on interior spaces, depicting how light became transformed through coloured glass, Newton was studying prisms of light and its behaviour as it passed through small apertures. Recently there have been similar parallel concepts between science and business. Businesses began slowly to engage in a world of connectivity through electronic networks at the same time that quantum physicists began earnestly to explore the notions of cosmic interconnectivity. Scientists and business people use surprisingly similar language to describe the new world of interconnectivity[7]. Research in both fields revolves around contributions to 'growth and vitality'. The language of both has converged around 'partnerships', 'interrelationships' and 'mutual commitments'. Emergent thinking about organisations focuses on their abilities to self-renew and self-organise.

It is contended that business (and social) scientists have increasingly endeavoured to be rigidly scientific and mathematical in their appraisal of business problems and subsequent solutions, whereas pure scientists have moved along to describing new realities. The net effect of the first construct is a rigid management theory, scientific

[7] *Regarding the synchronicity across the boundaries of the sciences, refer Russel,1979 or Boring, 1950.*

appraisals of constraints and weaknesses which, in part, led to the notions of 're-engineering', 'restructuring', 'downsizing' and 'redesigning' to name but a few. With one of the guiding principles of nature being that at all levels, nature resembles itself, this parsimony of nature's laws is indicative of the following important consideration: **If nature uses certain principles to create her infinite diversity, it is highly probable that those principles could (or should) also apply to business organisations.**

For instance, it is likely that the movement towards participation is rooted in the changing perceptions of the organising principles of the universe as defined in quantum physics. Along with participation and leadership, the business world is confronted by information as the new (and basic) ingredient (and requirement) of the universe. Information is largely intangible, transcending time and space. It does not have to obey the normal laws of matter and energy and can assume form or communicate instantaneously anywhere and anytime in the information realms of society. In a business context, the problem is not only information overload (which technology should be able to address), it is the inexorable movement towards a new paradigm where information (generated and exchanged) will determine the future. Failure to recognise the generative properties of information will inhibit organisations and render them unable to manage in the Quantum Age.

Emerging from the constant flux, is a state of global stability whereby incremental movements merge into a whole that can resist most of the demands for change at global level. The motion that keeps all systems in harmony will be that of self-reference and self-renewal, thus replacing Newton's mechanistic regulated world. Thus, it is contended that from chaos and complexity comes a new notion of simplicity over revolution and re-engineering. In quantum physics, the world ceases to be a mere machine, finite or discrete. It describes the notion of de-engineering as more than a solution, rather a replacement for re-engineering (a *revolution*), when it is contended that

'Most of the other steps in our understanding of nature were really evolutionary in that they sprang from previously established foundations: facts were reorganised or connected in new ways, or seen in a different context. Quantum theory, however, broke away completely from those foundations;
it dove right off the end. It could not (cannot) adequately be described in metaphors borrowed from our previous view of reality because many of those methaphors no longer apply. But the net result has not been to obscure reality or make the nature of things more elusive and murky.
On the contrary, most physicists would agree that what quantum theory has brought to science is exactly the opposite – concreteness and clarity.'

Cole, 1985:106

6.2 THE CHAOS ENGINEERING DISCIPLINE

The Japanese have long since coined the term 'chaos engineering' [Aihara and Katayama, 1995], which has the same meaning as the de-engineering proposed above.

They define chaos engineering as

'generic studies on theoretical and technological foundations for possible applications of deterministic chaos.'

Aihara and Katayama, 1995: 103

They cite as examples the following:

- Chaotic parallel distributed processing
- Deterministic non-linear prediction
- Identification and modelling of non-linear systems
- Dynamic memory and search and
- Sensitive pattern recognition.

Concepts of deterministic chaos are influencing basic theories of engineering, such as computational theory, information theory and prediction theory. The most important focus of chaos engineering is to examine relationships between deterministic chaos and basic theories in engineering (mainly in neural networks).

In this thesis, the principle of chaos engineering will be equated with the notion of de-engineering and the self-organising principle of classic chaos theory as studied in Module II.

7. CONCLUSION

Since the early 1990s organisations have undergone radical transformations – generally under the name of BPR. This has resulted in downsizing and a host of other side-effects. The consequences and aftermath of the re-engineering intervention have been described here. What remains is the cleaning up after the intervention and the restoration of shattered stability. In this context, no manifesto for re-engineering or de-engineering is proposed.

David Kearns (Xerox) [1992: 128] maintains

'The key to competitiveness is not to mimic others but to play to our own competitive strengths .. We believe we need to take a broader view of organisational design. For we're convinced that architecture itself can be a remarkable source of competitive advantage.'

He also reiterated the importance of IT in redesign

'IT enables companies to co-ordinate behaviour without control through the hierarchy. It allows for autonomous units to be created that are linked together through information. It allows more 'loon coupling' without running the risks of lost co-ordination and control. Hierarchy is load-bearing walls.
IT is structure steel – a new way to build a frame.'

Two hundred years of knowledge accumulated in the managerial sciences cannot and should not be wiped out by decisions to restructure or re-engineer. Nor should such knowledge be ignored in any programme of organisational transformation. Like every other revolution, BPR claims to obliterate the past and build a brand new future. Yet re-engineering is anchored in over a century of scholarly pursuit of better ways to organise and to manage work, workers and work organisations. The fact remains that the more radical and dramatic the intervention, the more its potential harm, regardless of the benefits it brings.

This module has endeavoured to:

- Clearly map the role of re-engineering in organisations,
- identify the failures of re-engineering (and the reasons for this) and
- effectively clean up and follow through with *de-engineering*.

Focused interventions consist of a variety of targeted programmes. These include the use of technology to improve the work processes, making structural and organisational modifications, redesigning or restructuring processes (for example, eliminating or combining resources) and adding a concept, viewpoint or approach (for example, customer focus or quality control). Focused interventions are programmes of change which vary in their degrees of radicality and impact on the organisation.

To a large extent, the (incremental) TQM movement (originating from the 1980s) legitimised the need for change. This was followed by a strategic management approach as a comprehensive tool for competitiveness [Figure 41]. This was combined with global thinking and a redirection toward a global market place. It forced organisations seriously to question where they are (the 'AS IS' state) and where they intend heading (the 'TO BE' state). Porter introduced the five forces impacting in the organisation's environment and generic strategies to navigate between these. Hamel and Prahalad's [1994] introduction of the notion of organisational core competencies opened the door to the concept of BPR in the tracks of restructuring, downsizing, mergers and acquisitions, strategising and globalisation. Moreover, the technological input into organisational culture was growing, with new and vastly improved software, hardware and networks automating business functions. Champions of BPR claim that organisations will be entering the 21st century with concepts and designs that were introduced more than a hundred years ago.

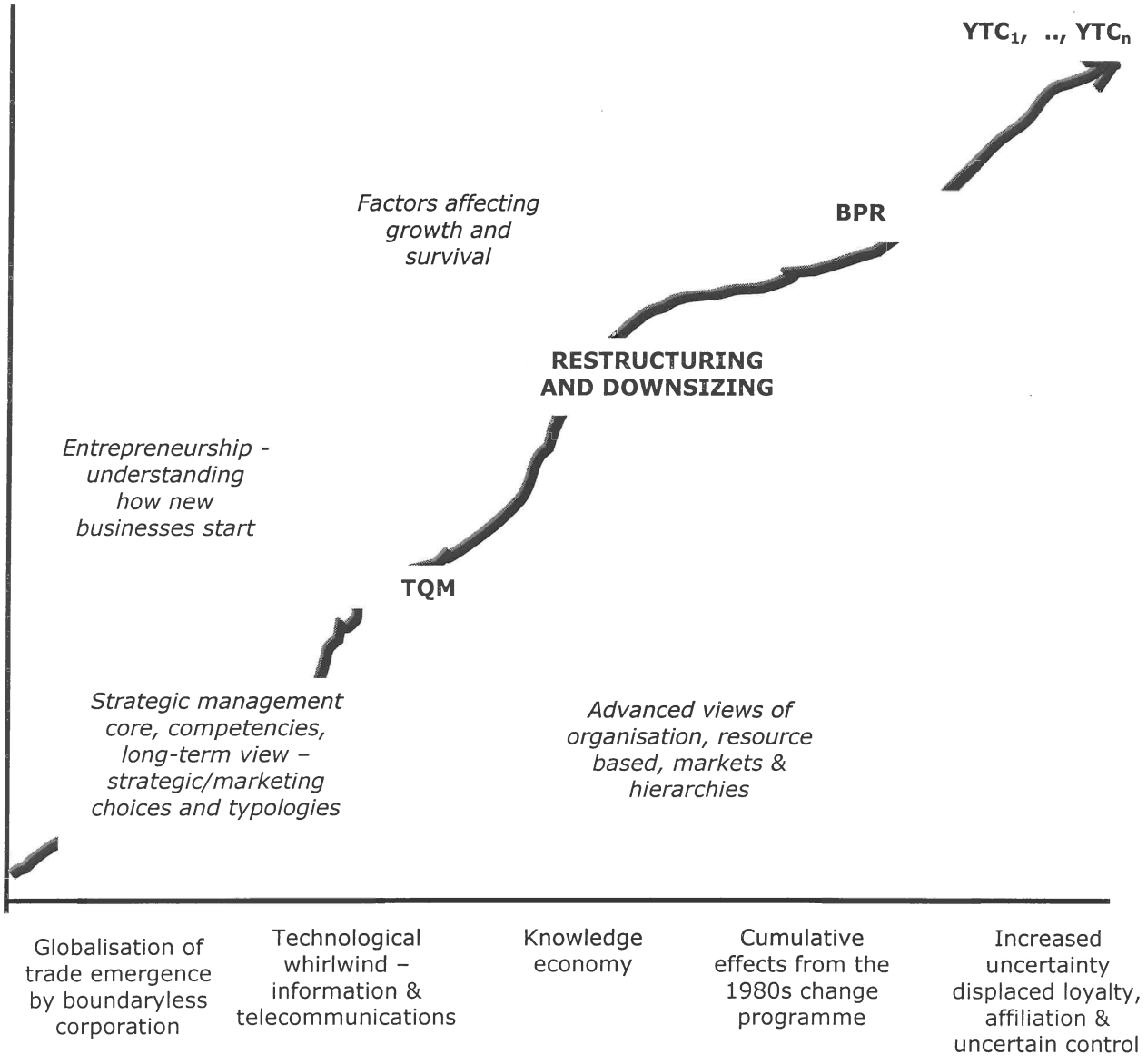


Figure 41: An evolutionary view of the new business world and important business enhancement programmes (YTC_I = programmes as yet not identified)
After: Geisler, 1997

The difficulty of creating adequate tools and usable knowledge for managers is compounded by the less than successful transfer of technologies. Three categories of transfer are identified by Geisler [1997].

These are:

- Intra-organisational,
- inter-organisational and
- intersector technology transfer.

(i) *Intra-organisational technology transfer*: Technology (including knowledge and information) is transferred within the organisation from one department to another.

(ii) *Inter-organisational technology transfer*: The transfer occurs between organisations where (generally) large organisations are required to share skills and technology with the smaller organisations they employ as suppliers. Compliance becomes an issue, especially on the part of the smaller business insofar as the utilisation and absorption of technology is concerned.

(iii) *Intersector technology transfer:* Difficulties in transfer within the same industry are enhanced when organisations belong to different industries/ sectors. This is the phenomenon where there is transfer of technology, knowledge and usable information from one sector of the economy to another. Cultural differences and the internal uniqueness of each sector, make this difficult to achieve. In addition, knowledge acquisition and adoption is a difficult process that requires the commitment of both organisations.

Consequently, the development of adequate and applicable knowledge and tools for managers is a difficult task to accomplish. It becomes a crisis in knowledge, forming

an integral part of the crisis in management. The difficulties in technology transfer above create enormous barriers to obtaining proper business intelligence. The consequence of this is a general lack of unifying theories and systems thinking. Geisler [1997] believes that this crisis in management can only be resolved by rapidly moving from re-engineering to regeneration.

Returning to the past (refer to Module I), the 19th century social theories with their tenets of loyalty to roots in the past, historical development and gradual evolution, were considerably more realistic and tenable than the blue sky dreams of the revolutionary Utopians [Sanders, 1997]. However, in a period rife with revolutions (for example, French, American and Napoleonic), this theory was considerably weakened by its inability to deal with momentous change. At this point in time, Karl Marx used Hegel's philosophy of dialectical materialism to synthesise social theory with some recognition of revolutionary change. Marx called upon social revolutionaries to seek their organisational ideal as a potentiality already organically immanent from within, but antithetical to the existing organisation. They would subsequently make a revolution to emancipate that potential organisation from whatever obstacles prevented its realisation.

Although Marx was mistaken in much of his economic and historical analysis, substituting '*business organisation*' for '*society*' and '*re-engineering*' for '*revolution*', one can apply his maxims to modern-day businesses. Thus, BPR in many ways restates both aspects of Marx's synthesis, namely revolution over evolution and holistic processes over fragmentation.

Consequently, when a business is lagging, gradual incremental (TQM-type) improvements will be insufficient to catch up with competitors and environmental changes. The second part of the Marxist synthesis is the organic character of the process that the revolution is to emancipate. According to BPR theorists, re-engineers are to hunt for potential processes to re-engineer within the fragmented activities of modern organisations. They must understand these processes without

obscuring their identity with an analysis of their disjointed parts. Finally they will replace fragmented tasks with holistic processes that integrate values, goals and customer needs, along with the nascent ability to satisfy them. This is a recurrent theme in Hammer and Champy's book. These authors identify a need to overturn the division of labour, which underlays the increased productivity of industrial economics. According to them [Hammer and Champy], the fragmentation of business processes (which worked well when processes were relatively simple and without the need for complex integration) is inadequate in a world of intense competition, geometrically accelerated rate of change and customer self-awareness.

Their BPR theory is as revolutionary as Marx's, although the revolution they preach, is a revolution from above. Serving as a sort of central nervous system, new information and communications technologies permit organisations to retain centralised intellectual control over resources and processes, while benefiting from the increased flexibility and customisation inherent in physical decentralisation. Finally, organic business processes have personalities – they are composed of people, having different values, needs and goals. The re-engineering/revolutionary tone is set by the authors when they consistently invoke violence and revolution in rhetoric and practice. Hammer and Champy's dogmatic pronouncements resonate with radical views put forward by other revolutionaries like Robespierre, Lenin, Mao and Marx. Some authors warn that by replacing some of Hammer and Champy's nouns, it is possible to produce slogans attributed to those who gained power by overthrowing the existing order. It is unlikely that the most widely read book on re-engineering (carrying the subtitle 'A Manifesto for Business Revolution' and claiming to be a seminal book comparable to Adam Smith's *'An inquiry into the nature and causes of the wealth of nations'* – the intellectual underpinning of capitalism) can successfully spread the premise that the only way to improve processes (or capitalism), is to obliterate them.

Figure 41, although not clear in futuristic scope, also attempts to show that re-engineering is by no means deemed the ultimate in business enhancement tools. It

forms part of a vast and broad band of evolutionary tools and techniques, each serving the forces of its time, each creating the pathways towards its own destruction. In Section 6 of this module, the notion of de-engineering (and chaos engineering) over re-engineering, was introduced to fill the gap left by re-engineering (as some 'YTC' methodology).

In a rapidly changing world, one can hardly even speculate upon the future content of subsequent techniques. It is for the scientists, the leaders and the members of the organisations to enlarge the scope of our knowledge. These evolving leadership styles and how they handle the Quantum Age complexities, is the focus of the next Module.

'It was our fault, and our very great fault –
and now we must turn it to use.
We have forty million reasons for failure,
But not a single excuse,
So the more we work and the less we talk
The better results we shall get.
We have had an imperial lesson;
it may mould us an Empire yet!'

Rudyard Kipling: The Lesson